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OF THE

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TO THE

SECRETARY OF THE INTERIOR

1891-'92

BY

J. W. POWELL
DIRECTOR

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DIRECTOR

OF THE

UNITED STATES GEOLOGICAL SURVEY.

Part I.—REPORT OF DIRECTOR.

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LETTER OF TRANSMITTAL.

Department of the Interior,
United States Geological Survey,
Washington, D. C., July 1, 1892.

Sir: I have the honor to transmit herewith a report of the operations of the Geological Survey for the year ending June 30, 1892.

I am, sir, with great respect, your obedient servant,

J. W. Powell
Director.

Hon. John W. Noble,
Secretary of the Interior.

THIRTEENTH ANNUAL REPORT OF THE UNITED STATES GEOLOGICAL SURVEY.

By J. W. Powell, Director.

PLAN OF OPERATIONS FOR THE FISCAL YEAR 1891-'92.

Previous to the beginning of the fiscal year the following plan of operations was submitted to the honorable the Secretary of the Interior and by him approved:

By the terms of the act of Congress approved March 3, 1891, making appropriations for sundry civil expenses of the Government for the year ending June 30, 1892, etc., there is appropriated for the work of the U. S. Geological Survey the sum of $596,400.

Separate amounts are by the terms of the act set apart for specific branches of work and for the salaries of persons connected with these branches. For convenience of reference I have brought together and classified the appropriation as follows:

For one general assistant		$3,000
For pay of skilled laborers, etc		15,000
For topographic surveys	$250,000	
For salaries 7 geographers and topographers	16,200	
Total for topographic work		266,200
For geologic surveys	$115,000	
For salaries 12 geologists	37,500	
Total for geologic work		152,500
For paleontologic researches	$40,000	
For salaries 2 paleontologists	6,000	
Total for paleontologic work		46,000
For chemical and physical researches	$17,000	
For salaries 2 chemists	5,000	
Total for chemical work		22,000
For preparation of illustrations, etc		16,000
For preparation Report on Mineral Resources		10,000
For engraving geological maps, etc		60,000
For purchase of books, etc		2,500
For rent		3,200
Total appropriations in the sundry civil act for salaries of scientific assistants and for general expenses of the Geological Survey		$596,400

TOPOGRAPHY.

Herewith is transmitted a map of the United States on which areas already surveyed are shown by a blue tint and those which it is planned to survey during the coming year by a pink tint.

It is recommended that topographic work east of the one hundredth meridian be continued under the direction of Mr. Henry Gannett, chief topographer, and that for this work there be allotted the sum of $125,000 plus six stated salaries amounting to $13,700, making a total allotment of $138,700.

It is recommended that topographic work west of the one hundredth meridian be continued under the direction of Mr. A. H. Thompson, and that for this work there be allotted the sum of $125,000 plus one stated salary of $2,500, making a total allotment of $127,500.

The following abstract of allotments for topography is followed by a detailed explanation of work contemplated:

Abstract of allotment for topography, 1891-'92.

	Eastern.	Western.	Total.
Supervision, disbursement, etc	$13,700	$6,000	$19,700
Northeast section, 9 parties	35,000	....	35,000
Southeast section, 4 parties	45,000	....	45,000
Central section, 5 parties	35,000	....	35,000
California gold belt, 4 parties	....	19,000	19,000
California, southern, 3 parties	....	12,000	12,000
Colorado (with South Dakota and Wyoming), 7 parties	....	29,500	29,500
Idaho, 2 parties	....	13,000	13,000
Montana, 3 parties	....	12,000	12,000
Texas, 5 parties	....	19,000	19,000
Washington	....	3,500	3,500
Special work	....	3,500	3,500
Office force	10,000	10,000	20,000
Total	138,700	127,500	266,200

SUPERVISION, DISBURSEMENT, ETC.

It is recommended that for the pay of the chief topographer in charge of the topographic work east of the one hundredth meridian, of stenographer, disbursing agent, and custodian of instruments; for the expenses of the astronomical and computing section, and for the maintenance of the shop for repair of instruments, including salaries of persons employed, and for other miscellaneous expenses, there be allotted the sum of $13,700.

The following persons are to be employed in this work: Henry Gannett, J. T. Ainsworth, S. A. Aplin, P. H. Christie, D. M. Hess, G. A. Hornig, S. S. Gannett, A. Kramer, E. Kübel.

It is recommended that the pay of the officer in charge of topographic work west of the one hundredth meridian, the disbursing agent, and for clerical assistance, the disbursement to be made in field or office as shall be most convenient, there be allotted the sum of $6,000.

The following persons are to be employed in this work: A. H. Thompson and J. W. Spencer.

It is proposed to divide the topographic work east of the one hundredth meridian into three sections—the northeastern, southeastern and central.

NORTHEASTERN SECTION.

It is recommended that this section be continued in charge of Mr. H. M. Wilson, geographer, and that work be prosecuted in (*a*) southwestern Maine by two parties working in the valley of the Kennebec river, (*b*) by two parties working in the White mountain region of New Hampshire, (*c*) by one party in the vicinity of Rutland, Vermont, (*d*) by two parties in the vicinity of Albany, New York, and (*e*) by two parties in the anthracite coal region of Pennsylvania. The proposed areas of work are shown on the accompanying map.

The following persons will be employed in this section:

Beaman, W. M.
Clark, E. B.
Dudley, A. F.
Hyde, G. E.
Jennings, J. H.
Johnson, G. L.
Lambert, M. B.
Lincoln, J. J.
Lovell, W. H.
McCormick, James.
Smith, G. S.
Sutton, Frank.
Thom, J. W.
Wheat, J. H.
Muldrow, R.

For the work above outlined it is recommended that there be allotted the sum of $35,000.

SOUTHEASTERN SECTION.

It is recommended that this section remain in charge of Mr. Gilbert Thompson, chief geographer, and that work be prosecuted (*a*) in the central part of West Virginia, (*b*) in eastern Kentucky and Tennessee, (*c*) in the Piedmont region of North Carolina, and (*d*) in northeastern Alabama in the area occupied by the Black Warrior coal fields. It is probable also that some three or four persons will be independently employed in miscellaneous inspection and revision work. The following men will be employed in this section:

Arrick, C.
Barnard, E. C.
Beall, W. O.
Cooke, C. E.
Crook, H. E.
Fletcher, L. C.
Frye, W. C.
Goodlove, C. W.
Hackett, M.
Hannegan, D.
Lincoln, J. D.
Longstreet, R. A.
Metzger, F. P.
Miller, W. L.
Munroe, H.
Murlin, A. E.
Nell, L.
Van Hook, C. G.
Yeates, C. M.

For the work above outlined it is recommended that there be allotted the sum of $45,000.

CENTRAL SECTION.

It is recommended that this section be continued in charge of Mr. John H. Renshawe, geographer, and that work be prosecuted (*a*) in southern Wisconsin, (*b*) in the valley of the Illinois river, Illinois, (*c*) in northern Kansas, and (*d*) in northwestern Arkansas. The following persons will be employed in this section.

Baldwin, H. L.
Blair, H. B.
Duke, B.
Griffin, W. H.
Harrison, D. C.
Hawkins, G. T.
Lackland, W. E.
Legare, B. P.
Manning, V. H.
Peters, W. J.
Searle, A. B.
Seeley, F. H.
Towson, R. M.
Tyler, Nat., jr.
Washington, B. C., jr.

For the work above outlined it is recommended that there be allotted the sum of $35,000.

It is proposed to divide the topographic work *west of the one hundredth meridian* into seven sections, as follows: California gold belt, California (southern), Colorado (with South Dakota and Wyoming), Idaho Montana, Texas, and Washington.

CALIFORNIA GOLD-BELT SECTION.

It is recommended that work be continued in the region known as the gold belt by one triangulation and three topographic parties, the whole to be under the direction of Mr. E. M. Douglas, who will have as his assistants Messrs. A. F. Dunnington, R. H. McKee, R. H. Chapman, H. E. C. Feusier, F. E. Gove, and P. V. S. Bartlett; and that for this work there be allotted the sum of $19,000.

SOUTHERN CALIFORNIA SECTION.

It is recommended that work be begun in southern California in the vicinity of Oceanside, San Diego county; that an area of four atlas sheets be mapped upon a scale of one mile to an inch; that the work be placed under the direction of Mr. Arthur P. Davis, assisted by Messrs. J. B. Lippincott, Fred J. Knight, and J. Ahern; and that for the work of this section there be allotted the sum of $12,000.

COLORADO, SOUTH DAKOTA AND WYOMING SECTION.

It is recommended that the work be carried on in Colorado, South Dakota, and Wyoming under the direction of Mr. Willard C. Johnson; that one party begin work at or near Rapid City, South Dakota; that one party begin work near Sheridan, Wyoming, and another near Fort Steele, Wyoming, while the remaining parties resume work in Colorado, adjacent to the area mapped last year and in the vicinity of Aspen. In this work Mr. Johnson will be assisted by Messrs. Morris Bien, C. H. Fitch, C. C. Bassett, R. C. McKinney, W. S. Post, W. B. Corse, Robert A. Farmer, Paul Holman, Stuart P. Johnson, and C. H. Stone.

For the work above outlined it is recommended that there be allotted the sum of $29,500.

IDAHO SECTION.

It is recommended that in this section surveys be made in the vicinity of Caldwell and of Boise; that the work be done on a scale of two miles to one inch; that the work be placed in charge of Mr. W. T. Griswold, assisted by Messrs. E. T.

Perkins, jr., and L. B. Kendall, and that for the work above proposed there be allotted the sum of $13,000.

MONTANA SECTION.

It is recommended that in this section work be begun at Custer station and extended southward and westward over four quarter-degree atlas sheets, all included within the Crow Indian reservation; that the work be done on a scale of two miles to one inch; that it be placed under the direction of Mr. Frank Tweedy, who will be assisted by Messrs. Robert B. Marshall and A. C. Barclay; and that for this work there be allotted the sum of $12,000.

TEXAS SECTION.

It is recommended that the work in Texas be placed under the direction of Mr. R. U. Goode, assisted by Messrs. R. O. Gordon, H. S. Wallace, C. F. Urquhart, W. S. Herron, Perry Fuller, C. B. Green, and E. M. Long; that five parties be organized, and work by four of them be carried on in the region adjacent to that of last year; that one party commence work at or near El Paso and work eastward; that the work be done on a scale of two miles to an inch, and that for the work above proposed there be allotted the sum of $19,000

WASHINGTON SECTION.

It is proposed to initiate work in the state of Washington, but the details of this work are not yet perfected. For the work contemplated it is recommended that there be allotted the sum of $3,500.

SPECIAL WORK.

For continuing the work of stream gauging in the arid region, under the direction of Mr. F. H. Newell, and the general study of the water problems of the arid belt, it is recommended that there be allotted the sum of $3,500.

MISCELLANEOUS OFFICE WORK.

To economically prosecute the general work of the Survey along the lines of topography, geology, paleontology, chemistry, etc., it is necessary to maintain a body of clerks and assistants constantly in this office. This body of employes are engaged upon work related to all the subdivisions of the Survey. They are employed in the general disbursing office, the division of miscellaneous correspondence, in the library, as messengers, etc. For the maintenance of this force it is recommended that there be allotted the sum of $20,000, of which $10,000 shall be taken from the appropriation for topography east of the one-hundredth meridian and $10,000 from that west of the one-hundredth meridian. The salaries of the following persons will be charged against this allotment:

Allan, J. E.
Bogan, C.
Brodhead, M.
Chipman, A. J.
Croffut, W. A.
Holford, C. N.
Morsell, W. F.
Mullin, E. V.
Spriggs, Dan.
Van Doren, N. G.
Warman, P. C.
Wilson, C. C.
Wirt, W. D.
Wood, G. M.

GEOLOGY.

The total appropriation for geological surveys in the sundry civil act is $115,000. Salaries of twelve geologists, $37,500. Total for geology, $152,500. The following abstract of proposed allotments for the different geologic sections is followed by a detailed explanation of plans.

Section.	In charge.	Amount.
Executive office, etc	Gilbert	$11,500
Division of geologic correlation	Gilbert	8,600
Atlantic coast division	Shaler	6,500
Archean division	Pumpelly	15,000
New Jersey division (joint work)	Pumpelly and Smock.	5,000
Potomac division	McGee	11,000
Appalachian division	Willis	12,750
Florida division	Eldridge	8,000
Lake Superior division	Van Hise	9,500
Division of glacial geology	Chamberlin	5,400
Division of zinc	Jenney	3,000
Montana division	Peale	3,500
Yellowstone Park division	Hague	13,000
Colorado division	Emmons	7,750
Cascade division and petrographic laboratory	Diller	8,700
California division	Becker	13,500
Salaries of Ward and White		5,700
Contingent		4,100
Total		152,500

EXECUTIVE OFFICE, ETC.

It is recommended that for the salary and expenses of the chief geologist, Mr. G. K. Gilbert; for the salary and expenses of Mr. C. D. Davis, assistant geologist and special disbursing agent; for the salary of Miss A. B. Dawson, clerk to the chief geologist, and Mr. W. M. Kirtland, general clerk of the geologic branch, there be allotted the sum of $11,500.

DIVISION OF GEOLOGIC CORRELATION.

For the purpose of assembling and discussing in a systematic manner the materials available for the correlation with one another of the formations of the United States, this division was constituted some years ago, being made up largely of geologists and paleontologists engaged in other divisions of the Survey. Its work is now so nearly completed that only a comparatively small number of persons will be occupied with it during any portion of the following fiscal year. Such persons are Dr. T. C. Chamberlin, Mr. W. J. McGee, Prof. C. R. Van Hise, and Mr. Lester F. Ward. It is proposed to continue the detail of these gentlemen and also to continue Mr. G. K. Gilbert in general charge of the work.

From time to time it is advantageous to conduct minor investigations occupying but a short time and entrusted often to persons not continuously employed by the Survey. Such investigations are attached for administrative purposes to permanent divisions of the Survey, and so far as practicable a division is selected in each case to which the special investigation is closely related. When such an arrangement is impracticable, special researches have been attached to the Division of Geologic Correlation, so as to receive the immediate supervision of the Chief Geologist without being formally constituted divisions of the Survey.

Mr. I. C. Russell, who has been engaged on the work of the Correlation Division, is now in Alaska in charge of an exploring party fitted out under the joint auspices of the National Geographic Society and the U. S. Geological Survey. After his return in the autumn it is proposed that he continue on the Correlation work.

Prof. J. M. Safford, of the University of Tennessee, is engaged under the auspices of the U. S. Geological Survey in the detailed study of a small district in western Tennessee where the Lower Paleozoic rocks are brought to the surface by a local uplift. It is proposed that he continue this investigation, giving to it such of his time as other duties permit and receiving compensation for the time actually employed. His field work is practically complete and office work only remains to be done.

It is proposed to continue a special examination of the rocks of the Newark system in the lower part of Connecticut valley and complete the mapping of that formation within the limits of Connecticut. This work is in charge of Prof. W. M. Davis, of Harvard University, who receives compensation only for the time given to the work of the survey.

It is proposed to complete the investigation of subsurface temperatures so far as it may be carried at the well near Wheeling, West Virginia, the work remaining in charge of Mr. William A. Hallock, of the Chemical and Physical Division of the Survey.

It is recommended that there be allotted for the purposes of this division the sum of $8,600.

ATLANTIC COAST DIVISION.

It is proposed that this division continue the mapping of the Pleistocene geology in the states of Rhode Island and Connecticut, that it continue work on the Narragansett coal basin, and that it continue office work on the Pleistocene maps of the state of Massachusetts.

The work will remain in charge of Prof. N. S. Shaler, and it is recommended that there be allotted to it the sum of $6,500.

ARCHEAN DIVISION.

The work of this division is the mapping of geologic formations on topographic atlas sheets prepared by the Topographic Branch. The principal formations to which it is devoted are the basal crystallines and metamorphic rocks which contain the great iron deposits of the country. It will continue this year the mapping of these rocks in Massachusetts, in southern and central Vermont, in western Connecticut, and in contiguous portions of New York. It is proposed to continue Prof. Raphael Pumpelly in charge, assisted by Prof. B. K. Emerson and Messrs. T. N. Dale and C. L. Whittle.

It is recommended that for the prosecution of the work of the division there be allotted the sum of $15,000.

NEW JERSEY DIVISION.

The work in New Jersey has recently been organized in cooperation with the Geological Survey of New Jersey. Under the terms of the coöperation the U. S. Geological Survey is to map the ancient crystalline and metamorphic rocks of the state, the rocks containing the great deposits of iron and zinc, and the state Survey is to map the superficial formations, from which the soils of the state are largely derived. The results of the work conducted by the two organizations severally are to be treated as the common property of both. Our work has been organized under the general supervision of Prof. Raphael Pumpelly and in immediate charge of Dr. J. E. Wolff.

It is recommended that this organization be continued and there be allotted to the prosecution of the work the sum of $5,000.

POTOMAC DIVISION.

It is proposed to continue the investigation and mapping of the geologic formations of the Atlantic coast from Delaware to Georgia, and of the Gulf coast from Alabama to Louisiana. The work of this division will remain in charge of Mr. W. J. McGee, assisted continuously by Mr. N. H. Darton and Mr. E. P. Hough, and during a portion of the year by Dr. George H. Williams, of Johns Hopkins University.

It is recommended that there be allotted to this work the sum of $11,000.

APPALACHIAN DIVISION.

It is proposed to continue in the Appalachian region the mapping of the formations on the atlas sheets prepared by the Topographic Branch. This division continues in charge of Mr.

Bailey Willis, assisted by Mr. Arthur Keith, Mr. C. W. Hayes, and Mr. R. M. Campbell.

It is recommended that there be allotted for the work the sum $12,700.

FLORIDA DIVISION.

This division was organized last January, and has up to the present time given chief attention to the deposits of mineral phosphate and their geologic relations. It was placed in charge of Mr. George H. Eldridge. Mr. L. C. Johnson, who had already a wide acquaintance with the formations of Florida, was transferred from the Potomac Division to this division, and the corps included also Mr. Edmund Jüssen.

It is recommended that there be allotted for the prosecution of this work the sum of $8,000.

LAKE SUPERIOR DIVISION.

The work of the Lake Superior Division consists in the discrimination and mapping of the formations on which the great mining industries in that region are founded. The division will remain in charge of Prof. C. R. Van Hise, assisted by Mr. C. E. Luther and Mr. W. M. Merriam, and Prof. C. W. Hall, of Minneapolis, Minnesota.

It is recommended that there be allotted to the work of this division the sum of $9,500.

DIVISION OF GLACIAL GEOLOGY.

This division is engaged in the study of superficial formations from which the soils of the northern states are derived. Dr. T. C. Chamberlin continues to give what time is necessary to the supervision of the work, and is assisted by Mr. Warren Upham, Prof. R. D. Salisbury, and Mr. Frank Leverett.

For the work of this division it is recommended that there be allotted the sum of $5,400.

DIVISION OF ZINC.

For the purpose of concentrating the work of this division so that it may yield definite results at an early day the scope of the work has been restricted to the southwestern mining district of Missouri.

It is recommended that the work remain in charge of Mr. W. P. Jenney and that for the completion of his field work and the preparation of his report thereon there be allotted the sum of $3,000.

MONTANA DIVISION.

The chief of this division is now in Montana completing the field work necessary for the final mapping of the Three Forks atlas sheet. A few weeks will suffice for this purpose, and it is proposed to devote the remainder of the year to the office preparation of the material for publication.

It is recommended that there be allotted to this work the sum of $3,500.

YELLOWSTONE PARK DIVISION.

The work of this division includes, first, the preparation of reports, on researches of which the field work is completed; second, the continuation of the mapping of the Livingstone atlas sheet of Montana, which lies immediately north of Yellowstone Park; third, the preliminary investigation of important coal fields lying east of the Livingstone sheet. The work is continued in charge of Mr. Arnold Hague, assisted by Mr. J. P. Iddings, Mr W. W. Weed, and Mr. E. H. Shuster.

It is recommended that there be allotted for the work of this division the sum of $13,000.

COLORADO DIVISION.

This division is engaged in the investigation of deposits of precious metals and of coal. It is chiefly occupied at present with the preparation of reports on field work previously accomplished, but it is proposed this summer to reexamine certain portions of the Leadville mining district for the purpose of adding data recently rendered accessible in the progress of mining operations. The division remains in charge of Mr. S. F. Emmons, assisted by Mr. C. W. Cross.

It is recommended that there be allotted to this work the sum of $7,750.

CASCADE DIVISION AND PETROGRAPHIC LABORATORY.

This division is occupied in tracing the limits of the geologic formations and marking them on maps. Its field of work is in northern California and it is this year occupied chiefly with the Susanville atlas sheet. Mr. J. S. Diller is in charge.

Mr. Diller has charge also of the petrographic laboratory of the Survey, to which are referred various questions arising within and without the Survey as to the constitution and nomenclature of rocks, and in which are prepared sections of rocks for microscopic study. The petrographic laboratory is likewise engaged in the collection of multiple suites of typical rocks to be distributed to educational institutions. In this work Mr. Diller is assisted by Mr.,W. S. Hunnell, Mr. H. Ohm, and Mr. F. C. Ohm.

It is recommended that there be allotted to the work of this division the sum of $8,700.

CALIFORNIA DIVISION.

The present work of this division is an investigation of the gold belt of California, including the study of the structure and origin of the gold-bearing formations and the mapping of the boundaries of all the geologic formations of the district. The work is in charge of Mr. George F. Becker, assisted by Messrs. W. Lindgren and H. W. Turner.

It is recommend that there be allotted for this work the sum of $13,500.

MISCELLANEOUS.

Mr. L. F. Ward and Mr. C. A. White, in charge of paleontologic divisions are engaged in both geologic and paleontologic work. Heretofore their salaries have been paid from the geologic fund and their expenses from the paleontologic fund, and it is recommended that this arrangement be continued. The salaries of these gentlemen amount in total to $5,700.

In the conduct of geologic work, as in all scientific research, contingencies arise which can not be foreseen, so that it is frequently advantageous to modify plans from month to month.

It is therefore recommended that there be held in reserve the remainder of the fund appropriated for geologic work, namely, $4,100.

PALEONTOLOGY.

The total appropriation for paleontologic work is $46,000, as shown on page 2. The following abstract of its proposed allotment is followed by a detailed explanation of plans.

	In charge.	Amount.
Paleozoic invertebrates	Walcott	$11,000
Lower Mesozoic paleontology	Hyatt	2,000
Upper Mesozoic paleontology	White	2,800
Cenozoic paleontology	Dall	6,200
Paleobotany	Ward	7,000
Fossil insects	Scudder	4,500
Vertebrate paleontology	Marsh	11,500
Contingent		1,000
Total		46,000

It is proposed that the paleontologic branch of the Survey shall continue its work of identifying and correlating geologic formations, by the study of their contained organic remains, and thus aid the geologist in the delineation of areal geology and in making geologic maps. The study of the faunas and floras contained in the rocks, from a biological standpoint, will also receive considerable attention, and in this connection collections of fossils will be made by trained collectors under the directions of the chiefs of the various divisions.

DIVISION OF PALEOZOIC INVERTEBRATES.

This division has charge of the four great formations of the Paleozoic. It is proposed to continue (*a*) the preparation of an illustrated report of the Middle Cambrian rocks and fossils; (*b*) the collection of fossils from the Silurian and Devonian rocks, in order to obtain a standard reference collection for the Survey; (*c*) the study of the sedimentation and faunas of the Paleozoic rocks of the Appalachian range from Alabama to the Canadian border, for the purposes of geologic correlation and mapping of the geologic formations.

This work will be in charge of Mr. C. D. Walcott, assisted by Prof. Henry S. Williams, John W. Gentry, and Ira Sayles.

Prof. Williams will continue to conduct the work on the Devonian and Carboniferous, with Mr. Sayles as an assistant. He will study the faunas with a view of using them in the correlation of geologic formations with precision, and study the bearing and distribution of the faunas on the history of the elevation of the eastern half of the North American continent.

Mr. Walcott will continue his work on the Cambrian and Silurian, assisted by Messrs. Loper and Gentry. He will also continue the study of certain unsettled questions relating to the correlation of formations of the northern Appalachian of New York and Vermont and of the southern Appalachian in Tennessee, Georgia, and Alabama.

It is recommended that for the prosecution of this work there be allotted the sum of $11,000.

DIVISION OF LOWER MESOZOIC PALEONTOLOGY.

The work of this division is limited to the Jurassic and Triassic formations, and it is proposed to have Prof. Alpheus Hyatt continue his work that he began in California last year and also to study the large collection that has been acquired by the various geologists, in order to enable him to correlate the formations from which they have been obtained with the determined geologic horizons occupying the same relative geologic positions in America and other countries.

It is recommended that for this work there be allotted the sum of $2,000.

DIVISION OF UPPER MESOZOIC PALEONTOLOGY.

It is proposed in this division to continue the preparation of a memoir upon the Laramie group and one upon the uppermost marine stage of the Cretaceous of the Atlantic and Gulf fauna. In the field, work will be continued on the formations of the Cretaceous in order to obtain stratigraphic and paleontologic data for the correlation of the various formations. In connection with this, large collections of fossils will be made, that are to be used in the preparation of the memoirs mentioned. The work in the office on the bibliography of works referring to the Cretaceous will be carried forward and probably completed before the end of the calendar year.

Mr. C. A. White remains in charge of the division and performs both geologic and paleontologic work. It is arranged that his salary, as heretofore, shall be paid from the appropriation for geology and the other expenses of the division from the appropriation for paleontology. He will be assisted by Mr. C. B. Boyle and Mr. T. W. Stanton.

It is recommended that for the work of his division there be allotted the sum of $2,800.

DIVISION OF CENOZOIC PALEONTOLOGY.

It is proposed to continue the work of this division in California, by having Mr. Dall make an examination of the Tertiary formation, in order to obtain more data for comparison between the Atlantic and Pacific Tertiary faunas. The other field work proposed will be confined to local examinations of the stratigraphy and the faunal horizons in the Tertiary of Virginia and Maryland. The principal laboratory work will be the continuation of the elaboration of the material accumulated during the past year and the working up of new material brought in from the field in reference to the correlation of the various formations referred to the Tertiary or Cenozoic group.

Mr. Dall will be aided in the work of the division by Mr. R. E. C. Stearns, Mr. Gilbert D. Harris, and such temporary help as may be necessary.

It is recommended that there be allotted for the work of this division the sum of $6,200.

DIVISION OF PALEOBOTANY.

It is proposed to continue the work of this division by, first, the preparation of an essay on the correlation of all the American plant-bearing strata; second, the systematic work on the bibliography of paleobotany; third, the completion of the preparation of a monograph on the flora of the Laramie terrain. Mr. Lester F. Ward is in charge of this division, and he should go over the plant-bearing beds of the Potomac formation in the vicinity of the valley of the Potomac, and, if possible, those of a supposed similar horizon in the state of Texas. Mr. Ward will be assisted by Mr. F. H. Knowlton, who will attend largely to office work; Mr. David White, who will, if possible, study the Carboniferous plant-bearing beds of southwestern Missouri; Mr. C. R. Prosser, who will continue the study of the relations of the Upper Devonian and Lower Carboniferous groups in New York and the Mississippi valley. Prof. William M. Fontaine is connected with this division, and proposes to collect extensively from the basal beds of the Carboniferous of Virginia, and to study the material during the winter as a basis for a memoir on the flora. Prof. J. S. Newberry sustains a similar official relation, and if he recovers his health he proposes to complete the monograph on the flora of the Amboy clays of New Jersey.

Mr. Ward performs both geologic and paleontologic work, and it is arranged that his salary be paid from the appropriation for geology, and the expenses of the division from the appropriation for paleontology.

It is recommended that there be allotted to the work of this division the sum of $7,000.

DIVISION OF FOSSIL INSECTS.

It is proposed to confine the work of this division largely to the elaboration of the collections now in the laboratory, on the following plan:

To continue the work proposed in the plan of operations for 1890–'91, and to study the Nemocerous Diptera, in order to obtain the data that they may afford for the purpose of correlation of geologic formations.

This work is under the charge of Prof. Samuel H. Scudder, who is assisted by Mr. J. Henry Blake.

It is recommended that there be allotted for the work of this division the sum of $4,500.

DIVISION OF VERTEBRATE PALEONTOLOGY.

It is proposed to continue the work in this division (1) by pushing on to completion the monographs that have been ordered, so as to place on record the facts that will be essential for a correct determination of geologic horizons; (2) to continue the elaboration of the collections in the laboratory, to prepare them for study; (3) to prosecute field investigations, for the purpose of defining more accurately the horizons of the Tertiary, and, as far as possible, to connect those west of the Mississippi with those of the Atlantic basin. A large collection of the vertebrate remains will be transferred for exhibition in the U. S. National Museum early in the year.

The work will remain in charge of Prof. O. C. Marsh, who will be assisted by Messrs. T. A. Bostwick and Adam Hermann. The field parties of the preceding year will be continued, and the laboratory work advanced as rapidly as possible.

It is recommended that for this work there be allotted the sum of $11,500.

It is recommended that the remainder of the paleontologic fund be held in reserve to meet contingencies arising from modifications of plans, as time may indicate to be desirable—$1,000.

CHEMICAL AND PHYSICAL WORK.

As stated in the last plan of operations, chemical analyses are essential to many departments of geologic work, and chemical and physical researches are important adjuncts to various lines of geologic study. It is proposed to continue such work during the coming year. From the nature of the work to be performed it is impracticable to set forth details in advance.

The same general lines of work as followed in former years will be continued, and the work, as heretofore, will remain in charge of Mr. F. W. Clarke. In addition to his scientific and administrative work in connection with the laboratory, Mr. Clarke is charged with the duty of preparing the Survey's exhibit for the Chicago World's Fair.

The following persons will be employed in this branch of the work:

Barus, C.
Chase, D. E.
Chatard, T. M.
Eakins, L. G.
Hallock, W.
Hillebrand, W. F.
Melville, W. H.
Schneider, E. A.
Stokes, H. N.

It is recommended that for this work there be allotted the entire appropriation, namely, $22,000.

AUXILIARY WORK.

DIVISION OF ILLUSTRATIONS.

It is proposed that this division, which has charge of field and office photography, the making of drawings, and the editing of all graphic matter published by the Survey, shall continue under the charge of Mr. De Lancey W. Gill, who will be assisted by

Cronin, D. W.
Cudlipp, M. A.
Hunter, H. A. C.
Jones, C. C.
Nichols, H. H.
O'Hare, D. P.
Ridgway, J. L.
Sawyer, W. M.
Selden, H. S.
Von Dachenhausen, F. W.

The appropriation for the work of this division is $16,000.

DIVISION OF MINING STATISTICS.

It is proposed to continue the collection and publication of statistics exhibiting the mineral resources of the United States, preparing an annual volume, as heretofore. Mr. David T. Day remains in charge of the work, his principal assistant being Mr. W. A. Raborg. He will also be assisted by Mr. E. W. Parker and Mr. A. Williams, jr. The sum appropriated for the work is $10,000.

DIVISION OF ENGRAVING AND PRINTING.

Of the amount appropriated for engraving the geologic maps of the United States, it is proposed to expend a portion in the execution of contract work and the remainder in work done by the Division of Engraving and Printing. The experimental work in engraving and printing, all revision work, and all the printing, it is proposed to do in the division. Mr. S. J. Kübel remains in charge, and will be assisted by the following:

Altmann, J. B.
Daniel, E. H.
Evans, W. D.
King, H.
Knight, H. T.
Kress, A.
Payne, R. H.
Souder, W. C.

The total amount appropriated for this work is $60,000.

LIBRARY DIVISION.

The library will be increased by exchange and by purchase, as necessity demands. For the expenses connected with the distribution and the purchase of material not obtainable by exchange, the appropriation is $2,500.

EDITORIAL DIVISION.

This division it is proposed to continue in charge of Mr. W. A. Croffut, who will be assisted by a small corps of clerks, detailed, some of them permanently and others from time to time, from other divisions, as need therefor arises.

ORGANIZATION OF THE WORK.

The following is a statement of the method by which the above plan of operations was carried out:

The preliminary work of the Geological Survey is a survey of the topography and the preparation of topographic maps suitable for displaying the rock formations and minerals of the country. A map designed for use in geologic surveying and afterwards for the graphic representation of rock formations and mineral deposits must be accurate and must represent the relief of the land in hills and valleys, mountains and plains, as well as the greater geographic features and the cultural features drawn on ordinary maps.

Experience has shown that maps designed for the use of the geologist are equally useful in various other ways, such as the location of roads, railways, and canals, and for planning towns and extensive manufactories, and drainage and irrigation systems, and for all other works depending on the configuration of the ground. The resources and industries of the country are many and constantly increasing, and the uses of maps for other than geologic purposes are multiplying with each decade. There is accordingly a double incentive to the energetic prosecution of the preliminary topographic survey of the country.

The topographic branch of the Geological Survey is, for reasons set forth in earlier reports, organized in two divisions, whose fields of work lie respectively east and west of the one-hundredth meridian. These divisions are made up of sections in which the work is carried on by independent parties. The sections and parties are so arranged and distributed that work is constantly in progress in nearly all parts of the country. More or less extensive topographic surveys have been prosecuted in nearly all of the states and territories by this branch of the bureau.

The chief work of the Geological Survey is the preparation of a geologic map showing the distribution and characteristics of the rock formations of the country with their various mineral contents. In order that the rocks and minerals may be adequately represented, it is necessary that the scale of the map shall be large—too large to permit convenient use without dividing it into sections. Moreover the country is extensive, and it is important that the surveys of each district shall be published as soon as completed, and not withheld for the completion of surveys in other districts. For these reasons the geologic map of the country has been planned to comprise a large number of sheets, each of convenient size and drawn to a scale adapted to the needs of the district to which it pertains.

The rocks and resources of different portions of the country are diverse, and the geologic survey of each district requires special knowledge of that district. Accordingly this branch of the work is organized in divisions, as set forth in earlier reports, each assigned to a particular district or series of formations. The divisions are commonly made up of subdivisions or sections, in which work is carried on by independent parties; and the several divisions are grouped in the geologic branch of the Survey. The distribution of the geologic surveys is determined in part by the industrial requirements growing out of the development of mineral resources in various parts of the country, and in part by the state of the topographic survey; for in general it is inexpedient to begin the geologic survey until topographic work is completed. The work has been so adjusted to these and other conditions, however, as to permit more or less extended operations by the geologic branch in every state and territory.

A geologic survey is a work of great complexity, involving researches into the chemical composition of minerals, the mineral constitution of rocks, the laws governing the origin of rock formations, the principles of classification of minerals, rocks, and formations, and other collateral subjects. Accordingly it has been found necessary to include in the organization of the Geological Survey a chemical and physical laboratory, in which special researches into the composition and relations of mineral substances are pursued; a petrographic laboratory, in which the constitution of rocks and ores is investigated, and a paleontologic branch, in which the fossils used in the classification of rock formations are studied and afterwards stored for future reference under the terms of the law instituting the National Museum.

The work of a geologic survey is determined by the characters and values of the rocks and minerals of the area examined. A large area must be divided into districts, and it is commonly expedient to lay out these districts in such manner that each coincides with definite groups of rocks or minerals, or definite economic or scientific problems. Now the definition of districts by the rocks and minerals contained therein involves more or less extended information concerning the rocks and minerals of each district. A part of this necessary information is recorded in the reports of earlier scientific surveys by the federal government or by states and in various trade publications; but the greater part of the requisite information, particularly that relating to recently discovered resources, can be obtained only by specific inquiry. To meet this need, a division of mining statistics and technology has been organized. The work of the division has become an important source of information concerning mines and minerals, and the mining, metallurgic, and other industrial processes growing out of the utilization of our material resources.

All such collateral researches are subordinate to the primary function of the survey, i. e., the preparation of a geologic map of the United States; yet their immediate results are frequently of great scientific and economic value, and are made public in one or another of the series of publications issued by the Geological Survey. The preliminary results of the work of the geologists, too, are of high scientific importance, and are published in the reports often in advance of the completion of mapping in the districts to which they relate, while the statistics of mineral resources are of standard value and in great demand, and are published in a series of annual volumes. To aid in the preparation of necessary illustrations for the documents published by the Survey a division of illustrations was organized, and there is also an editorial division, charged with the supervision of the work of publication.

The researches of the geologist are sometimes recondite and frequently require knowledge concerning previous researches in the same and other districts, and even in other countries. Thus, technical treatises are an essential part of the outfit of the working geologist, and to meet this need an extensive library of standard geologic books, pamphlets, periodicals and maps has been built up within the Survey.

In addition to the scientific organization there is a business organization, charged with the fiscal and custodial affairs of the Geological Survey. This branch of the work is largely intrusted to a distinct organic division, but a considerable part of the business is conducted by chiefs of divisions and parties and by other officers of the scientific branches. Provision is made also for the extensive clerical work of the office.

The organization of the primary and collateral work of the Survey is set forth in detail in earlier reports, particularly in the Seventh and Eighth Annual Reports, for 1885–'86 and 1886–'87 respectively. During the past year only a few minor changes in organization and personnel have been made. These are recorded in the accompanying administrative reports.

PROGRESS IN TOPOGRAPHIC WORK.

SURVEYING.

During the year topographic surveys have been conducted in twenty-six states and territories, the area surveyed being 53,000 square miles. The total area surveyed to date is 547,000 square miles, distributed over forty-two states and territories, as shown graphically in the accompanying Pl. I (in the pocket at the end of part 2).

The following table exhibits in detail by states the present condition of the work, including the surveys of the past year:

Table showing by states and territories the present condition of topographic surveys and the areas surveyed in 1891–'92.

States and territories.	Total area.	Area surveyed to date.	Area surveyed in 1891–'92.	Scale.	Contour interval.
	Sq. miles.	*Sq. miles.*	*Sq. miles.*		*Feet.*
Alabama	52, 250	15, 870	1, 000	1: 125000	50 and 100
Arizona	113, 020	41, 000	....	1: 250000	200 and 250
Arkansas	53, 850	15, 000	2, 000	1: 125000	50
California	158, 360	32, 300	3, 300	1: 125000 1: 250000	25, 50, 100, and 200
Colorado	103, 925	34, 110	1, 810	1: 62500 1: 125000	25, 50, 100
Connecticut (completed)	4, 990	4, 990	....	1: 62500	20
District of Columbia (completed)	70	70	....	1: 62500	20
Florida	58, 680	700	....	1: 62500	10
Georgia	59, 475	14, 275	....	1: 125000	50 and 100
Idaho	....	7, 340	3, 540	1: 125000	50 and 100
Illinois	56, 650	2, 875	1, 150	1: 62500	5 and 10
Iowa	56, 025	5, 375	....	1: 62500	20
Kansas	82, 080	61, 200	8, 000	1: 125000	20 and 50
Kentucky	40, 400	12, 800	1, 000	1: 125000	100
Louisiana	48, 720	7, 000	....	1: 62500	5
Maine	33, 040	3, 457	1, 000	1: 62500	20
Maryland	12, 210	6, 930	1, 000	1: 62500 1: 125000	20, 50, and 100
Massachusetts (completed)	8, 315	8, 315	....	1: 62500	20
Michigan	58, 915	231	....	1: 62500	20
Missouri	69, 415	26, 000	....	1: 62500 1: 125000	20 and 50
Montana	146, 080	13, 800	3, 000	1: 125000 1: 250000	50, 100, and 200
Nevada	110, 700	19, 980	3, 180	1: 125000 1: 250000	100, 200, and 250
New Hampshire	9, 305	1, 450	450	1: 62500	20
New Jersey (completed)	7, 815	7, 815	....	1: 62500	10 and 20
New Mexico	122, 580	26, 850	900	1: 62500	20
New York	49, 170	1, 995	900	1: 62500	20
North Carolina	52, 250	12, 400	2, 000	1: 125000	50 and 100
Oregon	96, 050	11, 000	....	1: 250000	200
Pennsylvania	42, 215	5, 437	700	1: 62500	20

Table showing by states and territories the present condition of topographic surveys and the areas surveyed in 1891-'92—Continued.

States and territories.	Total area.	Area surveyed to date.	Area surveyed in 1891-'92.	Scale.	Contour interval.
	Sq. miles.	*Sq. miles.*	*Sq. miles.*		*Feet.*
Rhode Island (completed)	1, 250	1, 250	....	1: 62500	20
South Carolina..........	30, 570	4, 350	....	1: 125000	50 and 100
South Dakota	77, 650	1, 500	1, 500	1: 95040	50 and 100
Tennessee...............	42, 050	17, 095	2, 000	1: 125000	100
Texas	265, 780	51, 050	10, 800	1: 125000	50
Utah	84, 970	6, 000	....	1: 250000	250
Vermont	9, 565	1, 010	450	1: 62500	20
Virginia....	42, 450	31, 410	....	1: 62500 1: 125000	20, 50, and 100
West Virginia...........	24, 780	22, 500	2, 000	1: 125000	100
Wisconsin...............	56, 040	5, 190	1, 350	1: 62500	20
Wyoming (including Yellowstone National Park)......	97, 890	5, 000	1, 000	1: 125000	50 and 100

As shown by the table and map, the topographic surveys of the states of Connecticut, Massachusetts, New Jersey and Rhode Island are completed, while considerable areas are covered in nearly all other states and territories.

The topographic surveys of the past year serve to complete 88 atlas sheets, of which 36 are on a scale of 1:62500 (or about one mile to the inch), and 45 twice as large—on a scale of 1:125000; the remaining 7, which are designed to accompany monographs, are drawn to special scales. The year's work raises the number of regular atlas sheets representing the topographic surveys to 295 on the scale of 1:62500, 338 on the scale of 1:125000, and 61 on the scale of 1:250000—a total of 694.

The topographic surveys east of the one hundredth meridian have remained in charge of Mr. Henry Gannett and those west of that line in charge of Mr. A. H. Thompson, and the details of organization and work are set forth in the administrative reports of these officers.

ENGRAVING.

The atlas sheets representing the topographic surveys are engraved on copper, partly in the office of the Survey and partly by contract, and the engraving is kept well up with the drawing of the sheets. During the past year 142 atlas sheets have been engraved, raising the present number of sheets engraved and ready for printing from stone transfers to 615. These sheets are distributed among forty-one states and territories.

The present condition of the engraving, including the work of the past year, tabulated by states, is as follows:

Table showing the distribution by states of atlas sheets engraved to June 30, 1892.

States and territories.	Wholly in state.	Partly in state.	Scale.	Contour interval.	Approximate area.
				Feet.	*Sq. miles.*
Alabama	13	3	1: 125000	50 and 100	14, 200
Arizona	13	2	1: 250000	200 and 250	58, 000
Arkansas	25	0	1: 62500 1: 125000	20 and 50	15, 000
California	17	3	1: 125000 1: 250000	50, 100, and 200	35, 000
Colorado	29	5	1: 62500 1: 125000	25, 50, and 100	30, 000
Connecticut	19	11	1: 62500	20	2, 475
Delaware	0	1	1: 62500	10	50
District of Columbia	0	2	1: 62500	20	70
Florida	2	0	1: 62500	10	500
Georgia	9	6	1: 125000	50 and 100	11, 800
Idaho	4	0	1: 125000	25, 50, and 100	3, 500
Illinois	8	7	1: 62500	10 and 20	2, 500
Indiana	0	1	1: 62500	10	50
Iowa	18	4	1: 62500	20	4, 500
Kansas	48	7	1: 125000	20 and 50	52, 000
Kentucky	6	7	1: 125000	100	10, 000
Louisiana	14	0	1: 62500	5	3, 500
Maine	9	3	1: 62500	20	1, 200
Maryland	11	9	1: 62500 1: 125000	20, 50, and 100	5, 000
Massachusetts	29	24	1: 62500	20	8, 300

Table showing the distribution by states of atlas sheets engraved to June 30, 1892—Continued.

States and territories.	Wholly in state.	Partly in state.	Scale.	Contour interval.	Approximate area.
				Feet.	*Sq. miles.*
Missouri	25	9	1: 62500 1:125000	20 and 50	33,500
Montana	11	0	1:250000 1:125000	50 and 200	34,000
Nevada	9	5	1:125000 1:250000	25, 50, 100, and 200	29,500
New Hampshire	0	12	1: 62500	20	1,100
New Jersey	32	12	1: 62500	10 and 20	7,815
New Mexico	15	3	1:125000 1:250000	100 and 200	28,500
New York	1	10	1: 62500	20	1,200
North Carolina	3	15	1:125000	100	8,000
Ohio	0	1	1:125000	100	50
Oregon	2	0	1:250000	200	7,000
Pennsylvania	14	6	1: 62500	20	4,000
Rhode Island	7	6	1: 62500	20	1,250
South Carolina	2	5	1:125000	50 and 100	2,500
Tennessee	7	16	1:125000	100	14,000
Texas	37	0	1:125000	20 and 50	37,000
Utah	17	1	1:250000	200 and 250	65,000
Vermont	2	5	1: 62500	20	1,000
Virginia	14	28	1: 62500 1:125000	20, 50, and 100	27,000
West Virginia	8	15	1:125000	100	16,000
Wisconsin	16	0	1: 62500	20	3,600
Wyoming	4	0	1:125000	100	3,600

In addition to the regular atlas sheets, three general maps of the United States, on different scales, have been prepared and engraved for use in representing general features of geology, topography, mining industries, etc. The "9-sheet" or wall map is engraved on a scale of 1:2500000, or approximately 40 miles to an inch, and represents the rivers, lakes, and other hydrographic features of the country in detail; the relief is shown by contours with approximate accuracy in the areas covered by topographic surveys and more roughly elsewhere; while the culture represented includes counties, county seats, and other principal towns, railways, and canals. The double folio or atlas map is drawn to a scale of 1:7000000, or about 110 miles to an inch, and represents all but the minor features of the hydrography, as well as the states and principal cities. During the year the relief of the country has been reduced from the "9-sheet" map and engraved on this scale in such manner as to be shown by contours and tints. (A copy of the map accompanies this report as Plate CVII in pocket of part 2, illustrating a paper by Mr. Henry Gannett.) The third or double quarto map, which, like the others, is engraved on copper, is on the scale of 1:14000000, or approximately 220 miles to an inch, and is of convenient size for use in the illustration of reports. It represents the principal waterways and lakes, together with the state boundaries, capitals, and principal cities.

There have been engraved also general maps of Massachusetts and Rhode Island on a scale of 4 miles to an inch and of Connecticut on a scale of 2 miles to an inch. A map of New Jersey has been prepared from surveys executed in accordance with the general plan of the topographic work in the bureau and has been engraved by the state on a scale of 5 miles to an inch. A complete map of New York city and environs has also been engraved on a scale of 1:62500, or about 1 mile to an inch. All of these smaller maps represent the hydrography, the culture, and the relief in considerable detail, the relief being indicated by contours and sometimes by tints in addition.

It is worthy of remark that the foregoing general maps are among the first to represent with approximate accuracy the relief of any considerable part of the country. Moreover, they are constructed from systematic surveys so far as such have been executed, and from the most trustworthy sources beyond the limits of the surveys. The general maps, as well as the atlas sheets, have come to be regarded as standard sources of geographic information in educational institutions and state and county offices. Both are also largely used as bases for the trade maps issued by publishing houses for various purposes, and in all ways are taking first rank among the original or "mother" maps of the country.

The Engraving Division remains in charge of Mr. S. J. Kübel. The details of this branch of the work and a list of the atlas sheets engraved to date appear in his administrative report, which is appended.

PROGRESS IN GEOLOGIC WORK.

GEOLOGIC MAPPING.

Various systems of geologic mapping have been employed in different states and countries, but no uniform standard has thus far been adopted. By the greater number of geologists and geologic bureaus rock formations and mineral deposits are represented by means of colors and other arbitrary conventions printed upon geographic or topographic maps; yet the selection of the colors and other conventions is not governed by fixed rules but depends on individual taste or judgment and local requirements, so that the whole subject of geologic mapping may be said still to be in the experimental stage.

This subject has been under investigation and experiment in the Geological Survey for some years, and a system of mapping has been devised which promises to meet the requirements of the country. This system was set forth in general terms in the Tenth Annual Report. Certain practical difficulties have been encountered in applying it, and repeated experiments have been found necessary in order to overcome them. This has involved some delay but geologic maps will be printed within the next six months that will fully exhibit the method adopted.

The plan for the publication of the projected geologic map of the United States provides that it shall be issued in sections corresponding with the topographic atlas sheets and that each atlas sheet shall serve as a base upon which the geologic formations and the conventions representing mines and minerals, rock structure, etc., shall be represented by means of colors and symbols. Now that the preliminary examinations are being completed in different portions of the country, constantly increasing attention is given to the final work of mapping the rock formations and mineral deposits, and satisfactory progress has been made in preparing for publication sections of the map representing portions of several states and territories. During the past year areal surveys yielding material for the map have been made in nineteen states and territories.

This branch of the work includes the determination of rocks and minerals in the several districts surveyed. The mineral substances and deposits examined in connection with the areal surveys during the year embrace nearly all of our more important natural resources, including the metals used in manufacture and construction, the various mineral fuels and illuminants, building materials of all kinds, artesian waters, the precious metals, materials for the manufacture of household and ornamental wares, gems and precious stones, and the substances yielding most other industrial and domestic commodities.

The progress of geologic mapping is shown graphically in the accompanying Plate II (in pocket of part 2), in which are indicated areas completely mapped, and also areas geologically surveyed in detail, but not yet topographically mapped. The much larger areas covered by geologic reconnoissance are not represented. The progress of geologic mapping and the principal mineral resources examined in greater or less detail are set forth in the accompanying table, in which only the regular atlas sheets are enumerated. There are in addition a large number of special sheets published in reports or still in the hands of the engraver. The areas tabulated in the fourth column, however, include not only those of the regular atlas sheets, but also those of the special sheets and the areas surveyed in sufficient detail for publication in the geologic map, but awaiting the engraving of uncompleted atlas sheets.

As indicated by the map and table, final geologic surveys of greater or less extent have been completed in 32 States and Territories, and these surveys cover an aggregate of 110,000 square miles, and are in part represented on 100 standard sheets and a large number of special maps.

Table showing the progress of geologic surveys and the principal mineral resources by states and territories.

States and territories.	Number of sheets.		Area surveyed.	Principal mineral resources.
	Wholly in state.	Partly in state.		
			Square miles.	
Alabama	2	2	5,500	Iron, coal, limestone, bauxite (aluminum ore), pottery clays, etc.
Arizona	1	....	14,000	Iron, coal, asphaltum, building stone, etc.
California	7	....	14,875	Gold (vein and placer), copper, iron, quicksilver, manganese, chrome iron, silver, coal, building stone, slate, limestone, pottery clay, infusorial earth, etc.
Delaware	....	....	50	Brick clay, iron, pottery clay, etc.
Colorado	*	....	2,150	Gold ores, placer gold, silver, copper, lead, zinc, iron, manganese, alunite, coal, petroleum, fire clay, brick clay, building and ornamental stones, artesian water, lime, gypsum, etc.
District of Columbia.	....	2	70	Brick clays, terra-cotta clays, sand, etc.
Florida	2	....	850	Phosphates, artesian water, lime, etc.
Georgia	3	1	3,900	Coal, iron, bauxite, building stone, lime, cement, etc.
Idaho	....	....	50	Building stone, etc.
Iowa	3	....	700	Building stone, brick clay, lime, artesian water, etc.
Kansas	....	....	100	Artesian water, building stone, brick clay, lime, cement, etc.
Kentucky	....	1	100	Coal, iron, building stone, etc.
Louisiana	6	....	1,500	Artesian water, brick clay, etc.
Maryland	13	6	†5,000	Terra-cotta clays, pottery clays, brick clays, marls, iron, granite, limestone, artesian water, etc.
Massachusetts	21	2	5,500	Granite, marble, slate, lime, feldspar, etc.

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* Special sheets (i. e., not coinciding with regular topographical atlas sheets) have been completed.

† Including water areas.

Table showing the progress of geologic surveys and the principal mineral resources by states and territories—Continued.

States and territories.	Number of sheets.		Area surveyed.	Principal mineral resources.
	Wholly in state.	Partly in state.		
			Square miles.	
Michigan	*		300	Iron, copper, etc.
Montana	2		10,000	Coal, iron, gold (placer and vein), silver, copper, lead, building stone, brick clay, artesian water, petroleum, etc.
Nevada			25	Gold, silver, quicksilver, etc.
New Jersey	2		†500	Fire clays, porcelain clays, marls, brick clays, artesian water, etc.
New Mexico	*		6,500	Lignite, building stone, etc.
New York		2	300	Slate, granite, lime, etc.
North Carolina		2	500	Iron, granite, etc.
Oregon			1,000	Coal, gold ore, placer gold, silver, quicksilver, nickel, etc.
South Dakota			1,000	Lignite, artesian water, etc.
Tennessee	5	3	9,500	Coal, iron, zinc, marble, lime, brick clay, building stone, etc.
Texas	6		6,000	Artesian water, chalk, cement, marl, building stone, etc.
Utah	2		2,000	Iron, lignite, building stone, hydrocarbons, etc.
Virginia		4	9,000	Coal, iron, lime, marl, ocher, infusorial earth, brick clay, pottery clay, artesian water, etc.
Washington			2,000	Artesian water, brick clays, building stone, etc.
West Virginia		2	750	Coal, iron, limestone, slates, etc.
Wisconsin	*4		2,000	Iron, copper, building stone, etc.
Wyoming (including Yellowstone National Park).	4		1,000	

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* Special sheets (i. e., not coinciding with regular topographical atlas sheets) have been completed.

† Including water areas.

PRELIMINARY SURVEYS.

The construction of a geologic map requires extended preliminary researches, and moreover industrial demands have sometimes led to the commencement of geologic surveys before the topographic surveys were completed and the atlas sheets engraved. Accordingly, large areas have been examined beyond the limits of the districts finally surveyed and mapped, as shown in the foregoing table and in Pl. II.

Among the more extended preliminary geologic surveys of the past year may be mentioned those in southern Alabama relating to Neozoic formations yielding brick clays, ochers, artesian waters, mineral waters, phosphates, etc.; in southeastern Arkansas relating to Neozoic formations yielding pottery clays, lignites, building sand, etc.; in southern and western Florida, relating to Cenozoic formations yielding phosphates, etc.; in western Kentucky and Tennessee relating to Neozoic formations yielding terra-cotta clays, ochers, brick clays, building sand, etc.; in Louisiana, relating to Neozoic deposits yielding sulphur, salt, iron, and various building materials; in eastern Maryland and Virginia, relating to Neozoic formations yielding marbles, ochers, infusorial earths, and various other useful mineral resources; in eastern North Carolina and South Carolina, relating to Neozoic deposits with their varied resources, among which artesian water and phosphates are prominent; in Texas, relating to various formations and resources; in Missouri and Iowa, relating to Paleozoic rocks yielding lead, zinc, iron, glass sands, building stones, etc.; in Michigan and Wisconsin, relating to iron-bearing and copper-bearing rocks. Moreover, more or less extended preliminary surveys have been made in all of the districts in which final mapping has been commenced. The area covered by preliminary survey or reconnoisance is many times greater than that covered by the final surveys and embraces portions of every state and territory, including Alaska.

SURVEYS IN ALASKA.

The commencement of explorations and surveys along the coasts and in the interior of Alaska was announced in the last report. During the past year the work has been continued in cooperation with other institutions by two parties. Mr. I. C. Russell headed an expedition to the St. Elias region, planned by the National Geographic Society, and spent the summer of 1891 in exploring the unknown territory immediately inland from the St. Elias mountains. He also continued his researches into the natural history of the great Malaspina glacier lying between the mountains and the coast. Mr. C. Willard Hayes accompanied as scientific assistant an expedition headed by Mr. Frederick Schwatka, organized for the purpose of exploring the region between the Yukon and Copper rivers not previously penetrated by white men. Despite the unfavorable conditions attending the journey, Mr. Hayes was able to collect valuable data concerning the rocks of the region traversed, as well as some information about gold, copper, and other mineral resources. Both of these Alaskan expeditions covered territory not previously seen by civilized people; and, in both, the routes traversed and the contiguous country were surveyed as accurately as circumstances permitted, so that both yielded valuable geographic information concerning a previously unexplored portion of the public domain, as well as data relating to the geology and mineral resources of the territory.

SPECIAL INVESTIGATIONS.

There is an area of over 500,000 square miles in the northern and northeastern portion of the country in which the older rocks are overlain by a deposit of glacial drift, and this deposit is not only one of paramount interest to the science of geology, but a storehouse of important resources. It comprises a variety of soils and is a source of building material in the form of bowlders, sand and brick clays; it sometimes yields artesian water, and occasionally carries gold, iron, and other useful minerals. This deposit has been under investigation for several years, and the progress of the work is set forth in earlier reports as well as in a number of special publications. The investigations and surveys have been continued chiefly under the direction of Prof. T. C. Chamberlin and Prof. N. S. Shaler. Several special maps and reports on this subject have been prepared during the year, relating chiefly to the glacial deposits of Ohio, Indiana, Illinois, Wisconsin and Massachusetts.

Special studies have been made of the Paleozoic rocks of a typical area in central Tennessee known as the Wells creek basin by Prof. J. M. Safford, and Prof. William M. Davis has made more extended examinations of the Newark (Triassic) sandstone or brownstone of the Connecticut valley, one of the principal sources of building-stone in the eastern United States. Both of these studies are preliminary to more detailed surveys.

During the year a deep boring at Wheeling, West Virginia, was found to afford favorable opportunities for the measurement of underground temperatures; this occasion was seized, and Mr. William Hallock was detailed to make the necessary observations. The determinations were satisfactory, yielding an underground temperature-gradient more useful than any previously obtained, either in this country or abroad. The results are not only of scientific interest, but have an important bearing on practical questions connected with deep mines and artesian wells.

The prime requisite for geologic mapping is the classification of rock formations and the correlation of the formations of given districts with those of other districts. It is to meet this need that the Division of Geologic Correlation is maintained. During the year the work of this division has been carried forward with energy, and several lines of study have been completed. Four bulletins on this subject have been published and three others are in press.

PUBLICATIONS.

Several important publications have been made during the year and a number of reports on various subjects have been finished and sent to press. Six special memoirs will be found appended to this report. The first is an account of the second expedition to Mount St. Elias, by Mr. I. C. Russell. The memoir is accompanied by maps representing Mr. Russell's surveys, as well as those of the earlier expedition made by Messrs. Russell and Kerr, and also by various illustrations indicating the character and capabilities of this little known territory.

It contains also the principal results of the scientific researches in geology and climate and the behavior of glaciers, as well as information concerning the structure and relations of the rocks making up the loftiest mountain range of the North American continent.

The second memoir, prepared by Prof. N. S. Shaler, is an account of the geologic history of harbors. It illustrates clearly the dependence of harbors, and so of foreign and domestic commerce, upon strictly geologic conditions and processes, and moreover indicates the rapidity and extent of the modification of existing harbors by the constantly operating geologic changes growing out of the action of tides and currents and the secular rise and fall of the land.

A third memoir, by Mr. Bailey Willis, deals with the mechanics of mountain structure as displayed by the Appalachian ranges. It is an important contribution to our knowledge of those obscure secondary movements among rocks by which the structure is altered in some cases so completely as to obscure or obliterate their original character to the extent that the formations can be identified, correlated, and mapped only after recondite researches in orogeny and paleontology combined.

A brief but useful memoir is a discussion of the average altitude of the United States, by Mr. Henry Gannett. The sources of knowledge concerning the configuration of the land surface of the United States are summarized, and the discussion may thus be considered an explanation or key to the relief maps of the United States engraved on two scales as noted above, and it is illustrated by one of the maps. The amount and character of the relief of the land have an important bearing on climate and on internal transportation and commerce, and this memoir and the map represent the latest information on the subject for this country.

Other accompanying memoirs relate to the Rensselaer Grit plateau, by Mr. T. Nelson Dale, and to the American Aphidæ, by Prof. Samuel H. Scudder. Both are important contributions to the branches of geologic science to which they pertain, though both represent the preliminary and preparatory studies rather than the final work of the Survey. Mr. Dale's memoir is, however, accompanied by detailed maps representing final areal surveys.

Among the quarto monographs prepared during the year is one on the Penokee iron-bearing series of northern Wisconsin, representing the work of the late Prof. R. D. Irving and his principal assistant and successor, Prof. C. R. Van Hise. This work embraces the principal results of surveys and researches extending over several years, relating to the ferriferous rocks of the Lake Superior region. It is illustrated by maps, sections, and plans, showing the distribution, character, and relations of the ore-bearing rocks of one of the principal iron regions of the country.

Another important monograph is that on the geology of the Eureka district of Nevada, by Mr. Arnold Hague. It is illustrated by maps, plans, and sections (in an accompanying folio atlas) and treats exhaustively of the distribution and relations of the silver, lead, and other minerals of one of the principal mining districts of the west.

A third monograph, issued during the year, relates to the plant fossils of the extensive lignite-bearing Cretaceous formation of the Great Plains, known as the Dakota group, by the late Leo Lesquereux, edited by Mr. F. H. Knowlton. A fourth monograph is a systematic treatise on the Gasteropoda of the New Jersey Cretaceous and Eocene marls, by Prof. R. P. Whitfield. These technical monographs are exhaustive treatises on the special scientific subjects to which they are confined.

A number of bulletins treating of a variety of scientific and economic subjects have been published during the year. Several of these belong to the series of "correlation papers" the purpose of which has been explained in previous reports. Collectively, these essays represent the sum of current knowledge concerning the relations of the rock formations of this country and set forth in detail the classification of rocks upon which future surveys must rest.

The annual volume of statistics relating to mineral resources, accompanied by special papers on various economic subjects, was published during the year.

PERSONNEL.

The work of the geologic branch has been conducted under the efficient charge of Mr. G. K. Gilbert, chief geologist. The organization and immediate control of the several geologic divisions, which have been but slightly modified during the past year, are as follows:

Atlantic Coast Division, in charge of Prof. N. S. Shaler.

Division of Archean Geology, New Jersey division, in charge of Prof. Raphael Pumpelly.

Potomac Division, in charge of Mr. W. J. McGee.

Appalachian Division, in charge of Mr. Bailey Willis.

Florida Division, in charge of Mr. George H. Eldridge.

Lake Superior Division, in charge of Prof. C. R. Van Hise.

Glacial Division, in charge of Prof. T. C. Chamberlin.

Division of zinc, in charge of Mr. W. P. Jenney.

Montana Division, in charge of Mr. A. C. Peale.

Yellowstone National Park Division, in charge of Mr. Arnold Hague.

Colorado Division, in charge of Mr. S. F. Emmons.

Cascade Division, in charge of Mr. J. S. Diller.

California Division, in charge of Mr. G. F. Becker.

Detailed statements concerning the work of this branch of the bureau are contained in the administrative reports by Mr. Gilbert and by the respective chiefs of the geologic divisions.

PROGRESS IN PALEONTOLOGIC WORK.

The work of this branch of the Survey has been carried forward along lines laid down in earlier reports, and its results are of constantly increasing service to the geologic surveys. During the past year the practical application of paleontologic research to the tracing and mapping of formations has been materially extended and important results have been obtained by providing for joint field work by paleontologists and geologists.

In the division assigned to the paleontology of the older rocks, Mr. C. D. Walcott has given attention both in the field and office to the Lower Silurian (Ordovician) formations and faunas in the vicinity of Canyon and Manitou, Colorado, and in addition he has continued the examination and mapping of the lower Paleozoic rocks in the northern portion of Washington county, N. Y., and the study and identification, by means of their contained fossils, of the Cambrian rocks of southwestern Virginia, eastern Tennessee, northwestern Georgia, and northeastern Alabama. Prof. H. S. Williams, who was attached to this division during a part of the year, continued his studies both in the field and office on the upper Paleozoic rocks of the Mississippi valley, especially in Arkansas, Missouri and Tennessee.

Paleontologic researches in the Mesozoic rocks have been continued by Mr. C. A. White and Prof. Alpheus Hyatt. Mr. White's studies have been confined to the upper Mesozoic, and during the year he has given special attention to the Colorado group of the upper Cretaceous in Montana and southwestern Wyoming, and has also continued work on the Laramie and related nonmarine formations. Prof. Hyatt advanced his examination of the lower Mesozoic rocks of the Pacific coast by cooperation with the field party in charge of Mr. J. S. Diller and also by the study of an important series of fossils collected by Mr. G. F. Becker and his collaborators in different parts of the gold field of California.

The work in Cenozoic paleontology has been continued by Mr. W. H. Dall and his collaborators, and has been largely concentrated upon the fossils and formations of the southern United States, including the phosphate beds of Florida. Special studies were also made by Mr. Dall on the Pacific coast, with a view to the correlation of the eastern and western formations of the country.

In the Division of Vertebrate Paleontology, in charge of Mr. O. C. Marsh, the field work has been continued in the regions explored during previous years for the purpose of obtaining accurate information in regard to the widespread Laramie formation (one of the principal sources of lignite and coal in the western plains and the eastern Rocky mountain region), and in regard to its relations to the deposits above and below it along the eastern flanks of the Rocky mountains. Large collections of vertebrate fossils were obtained and forwarded to the laboratory of the division for study, and satisfactory progress has been made in examining them.

Field work was carried on in the Division of Paleobotany, in charge of Mr. Lester F. Ward, in the middle and upper Devonian rocks of Pennsylvania, and the Potomac formation of Maryland, New Jersey, Tennessee, Mississippi, Alabama, Texas, and Arkansas. Collections were obtained at various localities in the several states mentioned and forwarded to the laboratory for study. In addition to this work a systematic review of the Laramie and Potomac formations and of several Carboniferous rock groups was carried forward during the year.

The work of the division of fossil insects, in charge of Prof. S. H. Scudder, has been confined mainly to the laboratory. A large amount of material was examined, prepared and classified and a monograph on the Tertiary Rhynchophorous Coleoptera of the United States was completed and transmitted for publication. One of the monographs published during the year was prepared in this division.

In connection with the proposed exhibit of the Geological Survey at the World's Columbian Exposition, in 1893, the members of the paleontologic branch are preparing a series of fossils and rocks to show in a broad way their stratigraphic succession on the North American continent during the geologic ages.

In order to correlate more fully the work of the various divisions engaged in the study of fossils, the administrative charge of the paleontologic branch has been assigned to Mr. C. D. Walcott. The details of work in the various divisions are set forth at length in the administrative reports relating to this subject and are summarized in Mr. Walcott's report.

PROGRESS OF WORK IN CHEMISTRY AND PHYSICS.

The greater part of the chemic work is of routine character. It embraces the analysis of ores, rocks and other mineral substances for the use of the several geologic divisions and sometimes for other departments of the government or public institutions. When the press of routine work permits, original researches into the constitution and essential relations of ores and rock-making minerals are conducted by the chief chemist and some of his collaborators. The immediate object of these researches is the discovery of the laws governing ore deposition and the making of rocks; a secondary object is the development of a natural system of mineral classification; while it is the ultimate object to gain such information concerning minerals and their relations as may indicate the location and value of the natural resources of the country and guide the search for material wealth not hitherto utilized. The work in chemistry is aided and supplemented by special investigations in physics relating to the conditions of mineral formation and to the effects of deformation and other changes in rocks.

Among the more important routine investigations of the year may be mentioned analyses of mineral waters of unusual character from Missouri and New Mexico; the assay of a remarkable magnetic mineral from Oregon, containing 62 per cent of nickel alloyed with iron; an extended series of analyses of phosphates from Florida; analyses of xenotine from North Carolina and bauxite (an aluminum ore) from Alabama, and a large number of analyses of rocks, including 16 from Massachusetts, 4 from Vermont, 8 from Maryland, 10 from Minnesota, 5 from Montana, and 10 from the Yellowstone National Park.

Among the original researches of the year may be mentioned exhaustive studies of the structure of the silicates, the most abundant by far among the rock-forming minerals; a complete theoretic discussion of the natural sources of the minerals known as the chlorite group; the continuation of a series of special observations on colloidal silver, and the examination of certain remarkable fluorites from Florida. The physical researches include the determination of melting points and the measurement of the thermal expansion of rocks, together with a study of the effects of temperature and pressure on the viscosity of solids, as well as other lines of work, all yielding important physical constants and laws of practical use to geologists.

The work of the division has remained in charge of the chief chemist, Mr. F. W. Clarke, the physical work being conducted or directed by Mr. Carl Barus. The details of the work are set forth in Mr. Clarke's administrative report.

PROGRESS OF WORK IN MINING STATISTICS AND TECHNOLOGY.

MINERAL VALUES.

During the past year the collection of mining statistics has been carried forward with energy and success by Mr. David T. Day, the chief of the division.

It is noteworthy that our mineral production is increasing rapidly. During the thirteen years that have elapsed since this Survey was instituted, our mineral production has more than doubled, while the population of the country has increased only about 30 per cent. A part of this addition is due to a relative decrease in importations, but the greater part represents industrial growth depending upon constantly increasing discovery and utilization of our natural resources. It is the function of the Geological Survey to stimulate and guide the discovery of new sources of wealth and promote the utilization of the old, and one of the means employed is the annual publication and wide distribution of statistics concerning mines and minerals.

The principal mineral products of the United States in 1891 are summarized in the following tables:

Metallic products of the United States in 1891.

	Quantity.	Value.
Pig iron .... long tons..	8, 279, 870	$128, 337, 985
Silver .... troy ounces..	58, 300, 000	75, 416, 565
Gold .... do....	1, 604, 840	33, 175, 000
Copper .... pounds..	295, 810, 076	38, 455, 300
Lead .... short tons..	202, 406	17, 609, 322
Zinc .... do....	80, 337	8, 033, 700
Quicksilver .... flasks..	22, 904	1, 036, 386
Nickel .... pounds..	118, 498	71, 099
Aluminum .... do....	150, 000	100, 000
Tin .... do....	125, 289	25, 058
Antimony .... short tons..	278	47, 007
Platinum .... troy ounces..	100	500
Total	....	302, 307, 922

. *Nonmetallic mineral products of the United States in 1891.*

	Quantity.	Value.
Bituminous coal ....short tons..	117,872,228	$117,147,983
Pennsylvania anthracite ....do....	50,665,431	73,944,735
Building stone		47,294,748
Petroleum ....barrels.	54,291,980	32,575,188
Lime ....do....	60,000,000	35,000,000
Natural gas		18,000,000
Cement....................................barrels..	8,222,792	6,680,951
Salt ....do....	9,987,945	4,716,121
Phosphate rock ....long tons..	587,988	3,651,150
Limestone for iron flux.....................do....	5,000,000	2,300,000
Mineral waters ....gallons sold..	18,392,732	2,996,259
Zinc white ....short tons..		1,600,000
Potter's clay ....long tons..	400,000	900,000
Borax ....pounds..	13,380,000	869,700
Gypsum ....short tons..	208,126	628,051
Grindstones		476,113
Mineral paints ....long tons..	47,652	658,478
Fibrous talc ....short tons..	53,054	493,068
Pyrites ....long tons..	119,320	338,880
Soapstone ....short tons..	16,514	243,981
Manganese ore ....long tons..	23,416	239,129
Asphaltum ....short tons..	45,054	242,264
Precious stones....................................		235,300
Bromine...................................pounds..	343,000	54,880
Corundum..............................short tons..	21,265	90,230
Barytes (crude) ....long tons..	31,069	118,363
Graphite..		110,000
Millstones		16,587
Novaculite ....pounds..	1,375,000	150,000
Marls ....short tons..	135,000	67,500
Flint ....long tons..	15,000	60,000
Fluorspar ....short tons..	10,044	78,330
Chrome iron ore.......................long tons..	1,372	20,580
Infusorial earth		21,988
Feldspar ....long tons..	10,000	50,000
Mica...pounds..	75,000	100,000
Cobalt oxide ....do....	7,200	18,000
Slate ground as pigment................long tons..	2,000	20,000
Sulphur ....short tons..	1,200	39,600
Asbestos....................................do....	66	3,960
Rutile ....pounds.	300	800
Ozocerite	50,000	7,000
Total		356,218,415

Résumé.

Metals	$302,307,922
Mineral substances named in foregoing table	356,218,415
Estimated value of mineral products unspecified	10,000,000
Grand total	668,526,337

Comparison of these tables with those published in preceding reports will show that while the production of most of our standard mineral substances is constantly increasing, the value increases much more slowly and sometimes not at all. This fact is of special significance in that it indicates a steady diminution in the cost of mining operations and the consequent reduction in prices of minerals and the various commodities with which they are associated in use. Accordingly, our industrial progress is materially aided not only by the discovery of the new resources and new methods for the utilization of the old, but by increasing economy in exploitation resulting from exact information concerning the character and location of minerals.

Considering the value of each mineral substance at the stage where it first receives a market price in commerce, the total value of all the products amounted to $668,526,337. This represents the largest product ever reached, although only slightly greater than in the preceding year, 1890. Such a great product was unexpected during the progress of the year, because of the far-reaching influence of the Baring failure in London, which resulted in a markedly conservative condition in all industries. Indeed, its effect in reducing the production of iron and steel was felt almost as severely in limiting the usual growth of the coal production and in other allied industries, but the production of copper, of lead and zinc, and of the precious metals showed a great and very unusual increase. The production of petroleum also increased on account of the discovery of new fields in Pennsylvania, and these influences combined were sufficient to offset the decline in the production of pig iron. The outlook for the present year, 1892, is for a product even greater than ever before, except in gold and silver.

METALS.

Iron and steel.—The production of pig iron declined from 10,307,028 short tons in 1890 to 9,273,455 short tons in 1891.

The production of most other manufactures of iron, notably steel ingots, steel rails, and cut nails, declined also. The product of pig iron was, however, greater than in any other country.

Gold and silver.—The output of gold aggregated 1,604,840 fine ounces (troy), with a value of $33,175,000; an increase of $330,000 over 1890. This product equaled that of 1888, and is larger than in any other year since 1881 with the single exception of 1886, when it reached $35,000,000. While there have been many new finds, notably in Oregon, Montana, and Colorado, there have been no rich strikes in the nature of bonanzas, and many old properties have been abandoned.

The silver product amounted to 58,300,000 ounces; a gain of 3,830,000 ounces over 1890. The coining value was $75,416,565. The commercial price of silver bullion averaged $0.988 per ounce.

The above statistics of gold and silver were collected by the Director of the Mint.

Copper.—Total product was 295,810,076 pounds, valued in New York at $38,455,300, against 265,115,133 pounds in 1890. Copper from imported pyrites is included in both years. The product is greater than in any previous year. The increase came from Lake Superior, Arizona, and California; Montana's output remained about the same as in 1890. The stock of copper declined in the United States.

Lead.—The product increased beyond all previous years to 202,406 short tons, worth in New York $17,609,322. The increase was in desilverized lead.

Zinc.—The total product was 80,337 short tons in 1891, against 63,683 short tons in 1890. Its value was $8,033,700. The product has been increasing each year since 1882. Nearly every important producer showed an increased output.

Quicksilver.—The product was practically the same in 1891 as in 1890. In 1889 it amounted to 26,484 flasks of 76½ pounds net. In 1890, 22,926 flasks were produced and 22,904 flasks in 1891. California was the only producing state. The largest producer, the New Almaden mine, declined to small proportions, but its decreased output was compensated by increases in others. In spite of decreased production over the world and also decreased stock the price declined. It is expected that the price will improve in 1892, but that the production will not increase.

Aluminum.—The amount made is constantly increasing. In 1890 47,881 pounds of metallic aluminum were made, besides 13,400 pounds of aluminum contained in ferro-aluminum and aluminum bronze. In 1891 this increased to 100,000 pounds of aluminum and 50,000 pounds in bronze and ferro-aluminum. The demand for experimental purposes increases. The total product in 1891, including that in alloys, is valued at $100,000.

Large deposits of bauxite have been found in Arkansas in addition to that which had already been mined in Georgia. Careful tests are being made to determine the availability of these new sources of supply.

Manganese.—The product declined from 25,684 long tons, worth $219,050 in 1890 to 23,416 long tons in 1891, worth $39,129. The decrease was in the Virginia mines, which was partly compensated by production in Colorado.

Nickel and cobalt.—In 1891 the Gap mine in Pennsylvania was the only actual producer of nickel and cobalt. Its product was 118,498 pounds, worth $71,099. In 1890 the total product was 223,488 pounds, worth $134,093. In 1891 the quantity of nickel from Canadian matte smelted in the United States exceeded the domestic product.

Chrome iron ore.—The production decreased from 3,599 long tons in 1890 to 1,372 long tons in 1891. It was valued at $15 per ton in San Francisco during 1891, but the price declined to $10 in 1892, and shipments were stopped after 300 tons had been delivered.

Tin.—The industrial production of tin began in California and amounted to 125,289 pounds, worth at the New York price $25,058. Machinery was erected at the Virginia mines for testing the value of the ore, and the mill in South Dakota was nearly complete at the end of the year.

Antimony.—The product consisted of 278 short tons of metallic antimony and antimony contained in exported ores, all valued at $47,007. This all came from Nevada. The mines in Idaho, which produced in 1890, are closed by litigation. The product in 1890 aggregated 129 short tons of metallic antimony, worth $40,756.

FUELS.

Coal.—The product increased from 157,788,656 short tons in 1890, worth at the mines $176,804,573, to 168,538,659 short tons in 1891, valued at $191,092,718. The gain in tonnage was 10,750,003, and in value $14,288,145. The production of Pennsylvania anthracite increased from 46,468,641 short tons in 1890 to 50,665,431 in 1891. In spite of a decreased production in the Connellsville coke region the yield of Pennsylvania bituminous coal increased about 500,000 tons, owing chiefly to increased consumption by local trade. The notable increases were in West Virginia, where a gain of nearly two million tons brings the product for 1891 to over 9,000,000, and in the Indian Territory, where the million-ton mark is touched for the first time. Ohio and Illinois, the two largest coal producers outside of Pennsylvania, report a somewhat larger output than in 1890.

Coke.—A strike in the Connellsville region from February until May effected a decrease of over a million tons in the product from Pennsylvania. In the Flat Top region the product was also slightly less than in 1890.

Petroleum.—The discovery of the McDonald and several other new fields in Pennsylvania, together with the increase in Ohio, resulted in a product of 54,291,980 barrels, worth, at the average price of oil at the producing centers, $32,575,188. This is the greatest product of any year in the history of the oil industry in the United States. In 1890 the product amounted to 45,822,672 barrels, worth $35,365,105.

Natural gas.—The product declined from a value of $18,742,725 in 1890 to $18,000,000 in 1891. The value used is that of the coal displaced. Efforts have been made to utilize the natural gas which has been observed for years on the eastern shore of Great Salt lake.

STRUCTURAL MATERIALS.

Stone.—The stone product of all kinds remains about the same being $47,000,000 in 1890 and $47,294,746 in 1891, not including the limestone used for lime. The lime amounted to 60,000,000 barrels, worth $35,000,000.

Cement.—The production of Portland cement is constantly increasing. In the year under review it amounted to 450,000 barrels. The total product of all kinds of cement aggregated 8,222,792 barrels, worth $6,680,951.

Limestone for iron flux.—This product declined with the pig-iron industry to 5,000,000 long tons, worth $2,300,000. In 1890 5,521,622 long tons were produced, worth $2,760,811.

MISCELLANEOUS.

Precious stones.—Turquois is now mined regularly in New Mexico. The sapphire mines in Montana are also to be opened systematically, and in the state of Washington a find of very valuable opals will be mined. The product in 1891 increased to a value of $235,300 from $118,833 in 1890. The gem mines of Paris, Maine, and North Carolina, were not operated.

Phosphate rock.—South Carolina produced 344,978 long tons of land rock, valued at $2,187,160, and 130,528 tons of river rock worth $760,977, as against 353,757 long tons of land rock and 110,241 tons of river rock, with an aggregate value of $2,875,605 in 1890. Phosphate mining in Florida had not settled down to a firm condition, and a great deal of rock was taken out without regard to the condition of the market. The consequence was that over 50,000 tons of land rock and 12,000 tons of river pebble were carried over January 1, 1892, having failed to find a remunerative demand. The Florida rock marketed consisted of 57,982 tons of land rock, worth $391,894, and 54,500 tons of river pebble, worth $285,890.

Marls.—The product in New Jersey is still declining; 135,000 tons, worth $67,500, comprised the output in 1891. The marls of Virginia were used to a slight extent.

Asphaltum.—The product consisted of 39,962 tons of bituminous rock from California, worth $154,164; 3,360 tons of the same material from Kentucky, valued at $6,000, and 1,732 tons of gilsonite from Utah. Part of this sold at Salt Lake City brought $2,000; the remainder was shipped to St. Louis for distribution and manufacture into varnishes, insulators, etc. The value at St. Louis is about $50 per ton. The total value for this portion of the product was $80,100. The combined value of bituminous rock and gilsonite was $242,264, against $190,416 in 1890, a gain of $51,848.

Salt.—Product in 1891, 9,987,945 barrels, worth $4,716,121. In 1890, 8,776,991 barrels, worth $4,752,286.

Bromine.—The product decreased from 387,847 pounds, worth $104,719 in 1890, to 343,000 pounds, worth $54,880 in 1891. The considerable decrease in value was caused by a decline in the price from 25 to 15 cents per pound. The decline was due to accumulated stocks.

Sulphur.—In Utah 1,200 tons were mined and sold at $33 per ton. No sulphur was mined in 1890.

Pyrites.—The demand is more than equal to the supply, and new mines are being opened in Virginia. The old mines at Ducktown, Tenn., will be reopened. Product, 119,320 tons in 1891, worth $338,880.

Graphite.—The product was limited to New York state and was valued at $110,000. The product in 1890 was worth $77,500.

Barytes.—The production continues to increase. The output, which came principally from Missouri and Virginia, and smaller amounts from North Carolina and South Carolina, was 31,069 tons in 1891. This was a gain of 9,158 tons over 1890, in which year the product was entirely from Missouri and Virginia.

Gypsum.—The product increased from 182,995 short tons in 1890 to 208,126 tons in 1891. The value increased from $574,523 to $628,051. The States producing it were California, Colorado, Iowa, Kansas, Michigan, New York, Ohio, South Dakota, Utah, Virginia, and Wyoming.

Mineral paints.—The product includes 25,142 short tons of metallic paint, worth $334,455; 18,294 short tons of ocher, umber, and sienna, worth $233,823, 4,091 tons of Venetian reds, valued at $90,000, and 25 tons of soapstone pigment worth $200.

Mineral waters.—The amount sold in bottles, barrels, etc., aggregated 18,392,732 gallons, worth $2,996,259, against 12,910,708 gallons in 1890, worth $2,091,189.

PROGRESS OF HYDROGRAPHIC WORK.

Among the lines of research conducted by the Geological Survey during the past year is that relating to the hydrography of the country. The subject was first taken up in the western portion of the United States under the law instituting an irrigation survey, but it has been found desirable to extend the observations and measurements into the eastern part of the country.

With the increase of population, hydrographic problems, always important, assume special prominence. In all parts of the country running waters are extensively controlled as a source of power for mills, manufactories, and other industrial works; and in many localities, especially in the West, but to a rapidly increasing extent in the East, the waters of rivers, streams, brooks, and springs are diverted for purposes of irrigation. Now it is necessary that the volume, the velocity of flow, the character and extent of freshets, the effects of drought and other factors in the regimen of streams shall be determined before they can be successfully controlled or diverted by means of dams, artificial reservoirs, raceways, and canals. While the problem of diverting and controlling running waters is one of hydraulic engineering, many of its conditions are strictly geologic, for a river or small stream is not simply a conduit carrying a given volume of water, but the most active known agent in modifying the surface of the earth. Streams are constantly engaged in excavating or in silting up and shifting their channels, and in carrying sand and other matter from the hills toward the lowlands or the sea, and thereby filling reservoirs; and, moreover, streams undermine dams and revetments, scour out weirs, and in other ways act upon artificial works. All of these modes of action are subjects of special study on the part of geologists, and it is accordingly important that the geologist should cooperate with the hydraulic engineer in dealing with the problem of diverting and controlling running waters for industrial purposes.

In another way the study of hydrography is of great importance to the country. All waterways are subject to freshets, and no year passes without destructive floods in some of our greater rivers, often entailing loss of life and immense damage to property, and sometimes followed by outbreaks of epidemic diseases. Moreover the extent, frequency, height and destructive character of floods are modified by cultivation of the soil, by deforesting, by the reclamation of marshes, by underdraining, and by other changes following settlement. Sometimes these changes result in diminishing floods, but in general the effect of settlement is to increase floods, and the consequent loss of life and property. Thus the study of floods and the determination of areas liable to periodical or occasional overflow is intimately connected with our industrial development.

Considerable progress has been made during the year in gauging rivers and in collecting information required for mapping lands subject to overflow in different parts of the United States. Attention has been given also to indicating available reservoir sites for manufacture and irrigation and feasible locations for raceways and canals in connection with the topographic surveys west of the one hundred and third meridian, in accordance with statutory provisions.

The Division of Hydrography is in charge of Mr. F. H. Newell, whose administrative report is appended hereto. The work relating to reservoir sites has been conducted by the western division of the topographical survey under Mr. A. H. Thompson, and the details of the work are set forth in the second part of this report.

PROGRESS OF OFFICE WORK.

WORK ON ILLUSTRATIONS.

This work has gone steadily forward, as during the preceding year, under the efficient direction of Mr. Delancey Gill, with nine assistants. There were produced during the year 1,619 drawings, a larger number than ever before in the same period. Of these, 667 are paleontologic delineations, 310 are geologic and topographic sections and diagrams, 41 represent geologic landscapes, 31 are maps, and the remaining 569 are miscellaneous. Engraved proofs of 1,070 drawings were received and revised.

The photographic laboratory attached to this division has remained in charge of Mr. J. K. Hillers, who had four assistants. During the year 1,637 negatives were developed, and 15,848 photographic prints were prepared.

The details of the work are set forth in Mr. Gill's administrative report, appended hereto.

WORK IN ENGRAVING.

The work of the Engraving Division has increased materially during the year. The force of engravers and assistants has been increased from 12 to 23, and a number of new presses and other appliances have been added. During the year 30 per cent of the engraving of topographic atlas sheets on copper plates was done in this division, against 15 per cent in the preceding year. In addition to this a large amount of experimental and miscellaneous engraving was executed, and a large number of engraved plates were corrected and revised. Most of this work grew out of the geologic mapping already noted. During the year there were printed a large number of proof copies of maps, including 131,000 copies of the 615 atlas sheets now engraved; 5,000 copies of the double folio base map of the United States on the scale of 1:7000000, in four colors, and 4,000 copies of the same map showing the relief by tints in thirteen printings; 3,000 copies of the 9-sheet map (making 27,000 sheets) in four printings, and 2,000 copies of the double quarto base map on the scale of 1:14000000. In addition a considerable amount of experimental and miscellaneous printing has been done, chiefly of different assemblages of colors and patterns for use in delineating geologic formations.

An important advance in the work during the year has been made through the introduction of the use of zinc plates for certain work, whereby a high grade of work has been maintained at a materially diminished cost.

Mr. S. J. Kübel remains in charge of the division. The details of his work, together with the list of the atlas sheets engraved to June 30, 1892, will be found in his administrative report. The general results of the work in engraving in the office and by contract are summarized in earlier paragraphs.

WORK IN THE LIBRARY.

There were received in the library during the year 1,549 books, 2,260 pamphlets, and 2,500 maps, raising the present content, of the library to 31,184 books, 43,377 pamphlets and 24,837 maps, or an aggregate of 99,998 pieces. The average circulation was about 1,000 per month, or over 12,000 for the year.

The preparation of catalogues described in previous reports has been continued. The authors' card catalogue now comprises more than 70,000 entries; of the special bibliography of American geology, 14,400 titles have been collected; and of the bibliography of American official geologic publications, 4,400 cards are ready for the printer.

The publications of the Survey are distributed, sold and exchanged through the library. During the year 21,555 books and pamphlets, and 21,266 map sheets were sent out by way of exchange; 4,337 copies of the survey publications were sold, yielding a return of $1,392.50; and 9,112 books and 9,848 map sheets were distributed gratuitously. The total number of books and maps distributed during the year is 66,116.

Further details of the work of the library may be found in the accompanying administrative report of the librarian, Mr. Charles C. Darwin.

EDITORIAL WORK.

The work of this division remains in the efficient charge of Mr. W. A. Croffut, the editor of the bureau. The activity of the work is fairly indicated by the number of pages corrected and returned to the public printer during the year, which is 8,979. A full account of the work appears in Mr. Croffut's administrative report.

DISBURSEMENTS

The fiscal business of the Survey remains in charge of Mr. John D. McChesney, chief disbursing clerk, who has, since the institution of the Survey, discharged the duties of his office with marked energy and fidelity. A detailed statement of disbursements will be found in his administrative report. This statement is summarzied in the following table:

FINANCIAL STATEMENT.

Amounts appropriated for and expended by the United States Geological Survey for the fiscal year ending June 30, 1892.

	Geological survey.	Office salaries.	Geological maps.	Total. appropriation.
Appropriation fiscal year ending June 30, 1892, act approved March 3, 1891	$536,400·00	$35,540·00	$60,000·00	$631,940·00
Amounts expended, classified as folllows:				
A. Services	397,637·99	35,437·39	20,855·31	
B. Traveling expenses	28,302·59		71·30	
C. Transportation of property	3,417·41		102·91	
D. Field subsistence	24,903·35			
E. Field supplies and expenses	40,133·90			
F. Field material	6,778·14			
G. Instruments	1,507·21			
H. Laboratory material	3,321·92			
I. Photographic material	2,427·01			
K. Books and maps	2,334·62			
L. Stationery and drawing material	1,483·78			
M. Illustrations for reports	132·00			
N. Office rents	3,739·92			
O. Office furniture	626·80			
P. Office supplies and repairs	2,585·07			
Q. Storage	1,305·94			
R. Correspondence	37·25			
S. Engraving material and supplies			10,469·33	
T. Bonded railroad accounts:				
Transportation of assistants ...... $1,812·14				
Freight ...... 177·34				
	1,989·48			
Total expenditures	522,664·38	35,437·39	31,498·85	589,600·62
Balance unexpended July 1, 1892	13,735·62	102·61	28,501·15	42,339·38
Probable amount required to meet outstanding liabilities, including contracts for engraving geological maps	13,735·62		28,501·15	42,236·77

The expenditures may also be classified by class of work and district of country, as follows:

Salaries, office of the director:	
Appropriated	$35,540·00
Amount expended to June 30, 1892	35,437·39
Unexpended balance	102·61

Salaries of scientific assistants:	
Appropriated	$67,700·00
Amount expended to June 30, 1892	67,640·22
Unexpended balance	59·78
Skilled labor, and various temporary employés:	
Appropriated	15,000·00
Amount expended to June 30, 1892	14,972·06
Unexpended balance	27·94
Topography:	
Eastern Division:	
Appropriation for stated salaries	11,700·00
Appropriation for miscellaneous purposes	125,000·00
Total appropriation	136,700·00
Expenditures:	
Administration and office work	23,988·37
Northeastern section (Maine, New Hampshire, Vermont, New York, Pennsylvania)	33,307·61
Southeastern section (West Virginia, North Carolina, Kentucky, Tennessee, Alabama, Florida)	46,118·80
Central section (Wisconsin, Illinois, Kansas and Arkansas)	33,090·67
Total expenditures	136,505·45
Balance to meet outstanding obligations	194·55
Total	136,700·00
Western Division:	
Appropriation for stated salaries	4,500·00
Appropriation for miscellaneous purposes	125,000·00
Total appropriation	129,500·00
Expenditures:	
Administration and office work	18,495·74
Colorado, Wyoming, and South Dakota	35,356·00
California	31,472·86
Idaho	8,676·90
Montana	7,964·16
Texas	22,593·31
Hydrography	3,474·41
Total expenditures	128,033·38
Balance to meet outstanding obligations	1,466·62
Total	129,500·00
Geology:	
Appropriation for stated salaries	37,500·00
Appropriation for miscellaneous purposes	115,000·00
Administration and office work:	
Appropriation	11,324·13
Amount expended to June 30, 1892	11,223·68
Balance to meet outstanding liabilities	100·45

Geology—Continued.

Division of Geologic Correlation:	
Appropriation	$13,975·87
Amount expended to June 30, 1892	13,508·94
Balance to meet outstanding liabilities	466·33
Atlantic Coast Division, Rhode Island, Connecticut, Massachusetts:	
Appropriation	6,800·00
Amount expended expended to June 30, 1892	6,328·55
Balance to meet outstanding liabilities	471·45
Archean Division, Massachusetts, Vermont, Connecticut, New York:	
Appropriation	15,000·00
Amount expended to June 30, 1892	14,218·31
Balance to meet outstanding liabilities	781·69
New Jersey Division:	
Appropriation	4,715·00
Amount expended to June 30, 1892	3,973·80
Balance to meet outstanding liabilities	741·20
Potomac Division, Atlantic Coast from Delaware to Georgia, Gulf Coast from Alabama to Louisiana:	
Appropriation	11,185·00
Amount expended to June 30, 1892	10,597·76
Balance to meet outstanding liabilities	587·24
Appalachian Division, Appalachian region:	
Appropriation	12,750·00
Amount expended to June 30, 1892	11,885·71
Balance to meet outstanding liabilities	864·29
Florida Division:	
Appropriation	8,000·00
Amount expended to June 30, 1892	7,935·20
Balance to meet outstanding liabilities	64·80
Division of Glacial Geology:	
Appropriation	5,400·00
Amount expended to June 30, 1892	4,428·39
Balance to meet outstanding liabilities	971·61
Lake Superior Division:	
Appropriation	11,000·00
Amount expended to June 30, 1892	9,561·94
Balance to meet outstanding liabilities	1,438·06
Division of Zinc, Missouri:	
Appropriation	4,100·00
Amount expended to June 30, 1892	3,920·86
Balance to meet outstanding liabilities	179·14

Geology—Continued.	
Montana Division, Three Forks, atlas sheet:	
Appropriation	$3,500·00
Amount expended to June 30, 1892	3,203·74
Balance to meet outstanding liabilities	296·26
Yellowstone Park Division, Wyoming and Montana:	
Appropriation	12,500·00
Amount expended to June 30, 1892	12,417·85
Balance to meet outstanding liabilities	82·15
Colorado Division:	
Appropriation	7,250·00
Amount expended to June 30, 1892	7,140·47
Balance to meet outstanding liabilities	109·53
Cascade Division and Petrographic Laboratory, northern California:	
Appropriation	10,900·00
Amount expended to June 30, 1892	9,830·73
Balance to meet outstanding liabilities	1,069·27
California Division, Gold Belt:	
Appropriation	14,100·00
Amounted expended to June 30, 1892	13,278·72
Balance to meet outstanding labilities	821·78
Amount appropriated for Geology	152,500·00
Amount expended to June 30, 1892	143,454·65
Balance to meet outstanding liabilities	9,045·35
Paleontology:	
Appropriation for stated salaries	6,000·00
Appropriation for miscellaneous purposes	40,000·00
Division of Paleozoic Invertebrates:	
Appropriation	11,000·00
Amount expended to June 30, 1892	10,438·37
Balance to meet outstanding liabilities	561·63
Division of Upper Mesozoic Invertebrates:	
Appropriation	3,300·00
Amount expended to June 30, 1892	3,028·69
Balance to meet outstanding liabilities	271·31
Division of Lower Mesozoic Invertebrates:	
Appropriation	2,000·00
Amount expended to June 30, 1892	2,000·00
Division of Cenozoic Invertebrates:	
Appropriation	6,500·00
Amount expended to June 30, 1892	5,759·11
Balance to meet outstanding liabilities	740·89

Paleontology—Continued.	
Division of Paleobotany:	
Appropriation	$7,000·00
Amount expended to June 30, 1892	6,992·59
Balance to meet outstanding liabilities	7·41
Division of Vetebrate Paleobotany:	
Appropriation	11,500·00
Amount expended to June 30, 1892	11,423·22
Balance to meet outstanding liabilities	76·78
Division of Fossil Insects:	
Appropriation	4,503·53
Amount expended to June 30, 1892	4,503·53
Amount allotted paleontology	46,000 00
Amount expended to June 30, 1892	44,145·51
Balance to meet outstanding liabilities	1,854·49
Chemical and Physical Researches:	
Appropriated for stated salaries	5,000·00
Appropriated for miscellaneous purposes	17,000·00
Total	22,000·00
Amount expended to June 30, 1892:	
Salaries and miscellaneous	21,698·61
Balance to meet outstanding liabilities	301·39
Total	22,000·00
Preparation of Illustrations:	
Appropriation	16,000·00
Amount expended to June 30, 1892	15,866·93
Balance to meet outstanding liabilities	133·07
Total	16,000·00
Report on the Mineral Resources of the United States	
Appropriation	10,000·00
Amount expended to June 30, 1892	9,751·51
Balance to meet outstanding liabilities	248·49
Total	10,000·00
Purchase of books for library, and transportation of public documents through the Smithsonian Exchange:	
Appropriation	2,500·00
Purchase of books	1,024·59
Transportation of public documents	1,011·77
Balance to meet outstanding liabilities	463·64
Total	2,500·00

Rent of office rooms in Washington, D. C.:	
Appropriation	$3,200·00
Amount expended to June 30, 1892	3,199·92
Unexpended balance	·08
Total	3,200·00
For engraving the Geological Maps of the United States, 1892:	
Appropriation	60,000·00
Amount expended to June 30, 1892	31,498·85
Unexpended balance	28,501·15
Balance to meet outstanding liabilities, including contracts for engraving maps, July 1, 1892	28,501·15

ACKNOWLEDGMENTS.

The work of the Geological Survey is in many ways connected with that of the other scientific institutions of the Government, and it is a pleasure to express indebtedness to the honorable Secretary of Agriculture as well as to several chiefs of bureaus in his department, to the Secretary of the Smithsonian Institution, to the Superintendent of the Coast and Geodetic Survey, and to the Director of the Mint for information and cooperation.

Much of the work of the Geological Survey depends for its success upon the scientific zeal and personal interest of the scientific men numbered among its officers; and it is a pleasure to the Director to express appreciation of these qualities among his collaborators and to acknowledge indebtedness to those who have aided him to maintain the standards of the bureau as an institution for research as well as for work in applied science. Special obligations are due Mr. G. K. Gilbert for his arduous labors in administering with skill and success the business affairs of the geologic branch.

THE AWARD OF THE CUVIER PRIZE.

The Academy of Sciences of the Institute of France, the foremost scientific body of that nation, has within its gift a prize designed to be awarded triennially for noteworthy work in science. Commonly the prize is awarded to investigators in France or neighboring countries; but during the past year the scientific corps of the Geological Survey has been collectively honored by the award of this signal mark of appreciation. It is an exceptional pleasure to acknowledge the receipt of this unusual and noble testimonial from one of the most eminent and conservative among the scientific institutions of the civilized world.

A translation of the decree of award, extracted from the transactions of the Academy, is appended:

[Institute of France, Academy of Sciences. Meeting of December 21, 1891. Pages 70-74.]

CUVIER PRIZE.

The Commission charged with awarding the Cuvier prize for the year 1891 has, with unanimous voice, given this high mark of esteem to the collective work of the Geological Survey of the United States.

In the United States, where all the natural resources are exploited with so much ardor, the studies relative to the soil ought necessarily to demand a very particular attention, by reason of the numerous applications which they legitimately promise. It is therefore more than half a century since the governments of many States instituted a geological exploration of the lands which belonged to them. These geological surveys were organized and confided to men most prominent in their profession. It was in the northern states that the most considerable progress was made. Hitchcock published in 1833 the Geology of Massachusetts. From 1836 to 1840 the eminent H. D. Rogers and his brother, W. B. Rogers, undertook that of Pennsylvania and of Virginia, the essential characteristics and distorted structure of which they so admirably made known.

Chas. T. Jackson, of Boston, the author of the discovery of etherization, and already known by his mineralogical works, undertook that of Maine, New Hampshire, and Rhode Island (1837-1839), after having published in 1833 a study of Nova Scotia. The geology of the state of New York was confided to James Hall (who has not yet discontinued the series of his discoveries), Mather, Emmons, and Vanuxem: it has given existence to publications that have become classic (1836-1842). By the side of these promoters who have the great merit of having been the first to conquer the greatest difficulties, justice demands that there should be written the names of two geologists not attached officially to the service of the United States, whose powerful influence ought to be proclaimed. Our compatriot de Verneuil pursued since 1846, with the success that is well known, a task which no other could better undertake, that of comparing upon the two continents all the sedimentary deposits, from the most ancient down to those that contain the coal. Dana, by his original work and by his excellent books, has contributed singularly to the education of all those who, in Europe as well as in America, devoted themselves and still devote themselves to the study of geology and mineralogy.

The first results attained proved the utility of like enterprises. Thus following the steps of the local governments the Federal Government entered into the same path.

It was at first for the great territories of the West, little known and not yet classed as independent states. The wise geologist Hayden, to whom this study was confided and of whom we deplore the loss, worked there with ardor during a dozen years. First of all had to be adopted a rational plan for an exploration at the same time geographic and geologic. This new service bore indeed the title of Geological and Geographical Survey of the Territories. Then followed the discovery in 1871 and the detailed exploration in 1872 of the region of the geysers of the Yellowstone; from 1873 to 1879, the complete topographic and geologic survey of the alpine part of the Rocky mountains comprised in the State of Colorado. The atlas which unites all these researches (1877) is a chef d'œuvre of cartography; it is in great part the work of Mr. Holmes, the artist-geologist, whose admirable and incomparable sketches are scattered in profusion through all the official publications.

In order to explore the Rocky mountains (1869–1875) Maj. J. W. Powell descended by water the celebrated and dangerous canyons of the Colorado and made a report which has become classic on the phenomena of erosion. During the same epoch Mr. Gilbert made an extremely remarkable study of the Henry mountains.

At the same time the Engineer Department of the United States Army was charged with work of the same class over an immense country still little more than desert and very little known. The title of this new service, "Geological and geographical exploration and survey of the one hundredth meridian," shows that in this case also the examination of the constitution of the soil marched side by side with the study of its topography and relief. This important mission was placed, in 1872, under the direction of Lieut. Wheeler, who in the preceding year had explored a portion of Nevada and Arizona. The choice could not have been better, as is proved by the career since then of that distinguished engineer. He exerted himself to exploit the natural resources of the mountainous country in the neighborhood of the chosen parallel and also of the great railroad lines of the Union and Central Pacific between the one hundred and fourth and one hundred and twentieth degrees of longitude west from Greenwich. After having examined the Sierra Nevada and the coast ranges, Prof. Whitney, director of the geological survey of California, pushed his investigations towards the Pacific. But, between California on the west and the base of the Rocky mountains on the east, exploited by Hayden, there remained a vast gap of sixteen degrees of longitude which was little known. Under the direction of Mr. Clarence King this gap was very well filled. A general knowledge was acquired of the great mountain system of North America and that in its greatest expansion. We now possess results sufficient to make clear the important problem of the dynamics of mountain chains.

Since 1879 all the geological studies executed at the expense of the central Government have been confined to a single administration bearing the title of the Geological Survey.

Organized by Clarence King it passed in the following year under the direction of J. W. Powell, in whose able hands it has since remained. Its end, as is defined by the organic law, is the reconnoissance of the geological structure of the country, of its mineral resources, and finally the execution of a geologic map.

The researches carried forward in very different directions of science have been apportioned to many divisions: geography, geology, paleontology, and others. Geologists to the number of about twenty are each one charged with special functions and their results are gathered each year into a report of the Director under the name of annual report. It is a large volume published in magnificent shape, in which are likewise collected memoirs upon divers subjects, with an accompaniment of numerous maps, engravings, and photolithographs. Already ten annual reports have appeared.

Besides these reports the Survey has published from time to time monographs upon subjects particularly interesting, likewise under the form of very beautiful volumes accompanied with many plates and occasionally by a voluminous atlas; also, under the title of bulletins, of which already have appeared sixty papers relating to subjects new and interesting; and, finally, a statistical publication bearing the name of "Mineral Resources of the United States," appears annually and makes known not only the figures of production, but also the numerous theoretical considerations which interest the miner.

As to the geographic work which the Geological Survey also possesses among its functions, a numerous personnel of topographers and engineers work actively at the execution of the map in the most diverse parts of the country, under the direction of Mr. H. Gannett. Already more than six hundred sheets have been surveyed and drawn; about four hundred have appeared.

Besides geology and geography ought to be mentioned a considerable work of which Mr. Powell is the founder, in the domain of the precolumbian archæology, the linguistics, the ethnology, and the anthropology of the Indians of North America, splendidly illustrated by Mr. Holmes. The last publication of Mr. Powell upon the classification of American languages is, according to the best judges, of great importance.

Not being able to give here a complete list of all the actual collaborators of the Geological Survey or of their services, we must content ourselves with noticing those who have taken the principal part in the execution of the works already published. These are in alphabetical order:

Messrs. Becker, Chamberlain, Cross, Davis, Day, Diller, S. F. Emmons, Fontaine, Gannett, Gilbert, Hague, Hayes, Holmes, Iddings, McGee, Marsh, Newberry, Peale, Russell, Shaler, Van Hise, Walcott, Ward, Upham, Weed, C. A. White, Whitfield, A. Williams, G. H. Williams, H. S. Williams. It is but just that we should not omit the names of those who are dead: Messrs. Hayden, Irving, Lesquereux, Leidy, Marvine, Newton; or of those who no longer belong to the Survey: Messrs. Bradley, Cope, Curtis, Dutton, Endlich, Hill, Howell, Clarence King, St. John, Stevenson, Wheeler. Many of these names will remain justly illustrious.

It will be impossible to give in this report even a summary idea of the most remarkable discoveries which are due to the Geological Survey. They belong to branches very diverse: regional geology, monographs concerning metalliferous deposits, general and comparative stratigraphy, mineralogy, and petrography, volcanic phenomena, glacial phenomena, ancient Quaternary lakes, history of the Atlantic littoral.

Among the most considerable results must be mentioned the paleontological discoveries made in the Rocky mountains. Since the day in which Hayden undertook his memorable explorations we have learned that the site of the Rocky mountains was continuously a part of the continent during the greater part of the Secondary, Tertiary, and Quaternary epochs. Upon this vast continent the quadrupeds could develop during extended time freely, without any interruption to their evolution, and thus they became numerous, gigantic, sometimes strange. The paleontologists attached to the Geological Survey have brought to light these curious creatures. The monographs of the lamented Leidy, of Cope, and of Prof. Marsh are among the most beautiful paleontologic works accomplished since Cuvier.

Magnificent researches have also been made concerning the invertebrates and the fossil vegetables.

To sum up, under the powerful impulse which the Federal Government has given to it, the geologic service of the United States has produced in twenty-five years results very considerable and very skillfully attained. It must be said that in no other region of the globe have been made such discoveries in so short a space of time.

Moreover, this organization, perfect as it is, could not have borne such fruits if the galaxy of savants who have taken part in it had not given proof, at all times, of a valor and of a tenacity which, in the diverse and inhospitable regions in which they were exercised, recall the heroism of an army attacking the most arduous and most inaccessible obstacles.

The work of the Geological Survey, with the magnificent collection of results that it comprises, merits then that we should render to it a striking homage for the light so vivid and so unhoped for that it has thrown upon the geologic history and the mineral riches of North America.

The Cuvier prize is decreed to this grand collective work, not only to present collaborators, but also to those who have ceased their labors.

It will, we hope, be preserved in the archives of the Geological Survey as a witness of the high esteem of the Academy of Sciences.

GAUDRY,
FOUQUÉ,
DE QUATREFAGES,
MILNE-EDWARDS, *Commissioners.*

M. DAUBRÉE, *Recorder.*

The value of the Cuvier prize is 1,500 francs. Since the acceptance of pecuniary gifts by federal employees is prohibited by law, the tender of the money prize was declined. The honorable commissioners of the academy then proposed to substitute a gold medal, which, under authorization from the honorable the Secretary of the Interior, was accepted, and the splendid souvenir is preserved in the Survey library. A balance remained after the completion of the medal, and on the recommendation of the Director of the Survey this was covered into the Cuvier fund.

DEPARTMENT OF THE INTERIOR, UNITED STATES GEOLOGICAL SURVEY.

ADMINISTRATIVE REPORTS
OF
CHIEFS OF DIVISIONS
AND
HEADS OF INDEPENDENT PARTIES,
ACCOMPANYING THE ANNUAL REPORT OF THE
DIRECTOR OF THE U. S. GEOLOGICAL SURVEY
FOR THE
FISCAL YEAR ENDING JUNE 30, 1892.

ADMINISTRATIVE REPORTS.

REPORT OF MR. HENRY GANNETT.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
EASTERN DIVISION OF TOPOGRAPHY,
Washington, D. C., June 30, 1892.

SIR: During the fiscal year ending to-day work in the eastern division of topography has been carried on in fifteen states, namely, Maine, New Hampshire, Vermont, New York, Pennsylvania, Maryland, West Virginia, Kentucky, Tennessee, North Carolina, Alabama, Wisconsin, Illinois, Kansas and Arkansas.

The area surveyed is 25,000 square miles. Of this 7,000 square miles were surveyed upon a scale of 1:62,500, with contour intervals of 10 and 20 feet, and 18,000 square miles on the scale 1:125,000, with contour intervals of 20, 50, and 100 feet.

The number of atlas sheets completed by the season's work was fifty, of which thirty-three were on a scale of 1:62,500 and seventeen on a scale of 1:125,000. The area surveyed is distributed as shown in the following table and on the map which constitutes Plate I of this report:

State.	Scale of field work.	Scale of publication	Contour interval.	Area surveyed.
			Feet.	*Sq. miles.*
Maine	1:45000	1: 62500	20	1,000
New Hampshire	1:45000	1: 62500	20	450
Vermont	1:45000	1: 62500	20	450
New York	1:45000	1: 62500	20	900
Pennsylvania	1:45000	1: 62500	20	700
Maryland	1:63360	1: 62500	20	1,000
West Virginia	1:63360	1:125000	100	2,000
Kentucky	1:63360	1:125000	100	1,000
Tennessee	1:63360	1:125000	100	2,000
North Carolina	1:63360	1:125000	50	2,000
Alabama	1:63360	1:125000	50	1,000
Wisconsin	1:31680	1: 62500	20	1.350
Illinois	1:31680	1: 62500	10	1,150
Kansas	1:63360	1:125000	20	8,000
Arkansas	1:63360	1:125000	50	2.000

ORGANIZATION.

During the season the organization of this branch has remained substantially the same as during the latter part of the preceding year. The field work has been organized in three sections, designated, respectively, as the Northeastern, Southeastern and Central sections.

The Northeast section has included all work done in the states north of the Mason and Dixon line and east of Ohio; the Southeastern section all work executed south of the Mason and Dixon line and the Ohio river and east of the Missssippi river; the Central section all work in the Mississippi valley east of the one hundredth meridian.

Besides these field sections there has been maintained under control of this division a party for making astronomical determinations for office computations and an instrument shop for the adjustment and repair of field instruments.

During the field season an average of ninety men were in the employ of this division, of whom sixty-eight were engaged in professional work, consisting of topographers, assistant topographers, and field assistants, the remainder consisting of the laboring force, such as cooks, drivers, and signal men. During the winter there were employed in the office an average of sixty-five men.

NORTHEASTERN SECTION.

This section has remained throughout the year in charge of Mr. H. M. Wilson, geographer. It has surveyed an area of 3,500 square miles, completing sixteen atlas sheets, all on a publication scale of 1:62500, with a contour interval of 20 feet. The field of work lay in southern Maine, the White mountains of New Hampshire, southern Vermont, eastern New York, and the anthracite coal regions of Pennsylvania.

The parties of this section took the field during the months of May and June. Work in Maine was resumed by Messrs. J. H. Jennings and W. M. Beaman. To the former was assigned the survey of the Norridgewock and Waterville sheets. He pushed his work with his usual vigor and good effect, and by the end of August had completed these two sheets. He was then ordered to the Adirondacks of New York for the purpose of surveying a small area about Mount Marcy, in the heart of that region. The area designated was finished early in October, and Mr. Jennings devoted the remainder of the season in assisting Mr. Sutton in the completion of the Troy, New York, sheet.

To Mr. Beaman was assigned the survey of the Wiscasset and Boothbay sheets, near the coast of Maine, a region of much detail, especially in the neighborhood of the broken and irregular coast line. These sheets were completed by Mr. Beaman during the season.

To Mr. W. H. Lovell was assigned the survey of the Mount Washington and Gorham sheets in the White mountains of New Hampshire. He took the field early in June, and, after a little time spent in acquainting himself with the different conditions of topography and methods, made good progress, and completed the sheets at the close of the season.

To Mr. G. E. Hyde was assigned the survey of the Rutland and Wallingford sheets in southern Vermont, comprising the high country in the Green mountains. These sheets were completed at the close of the season.

Work was conducted in New York at two points on the Hudson. To Mr. Frank Sutton was assigned the survey of the two sheets near the junction of the Mohawk and Hudson rivers, the Troy and Albany sheets, both of which are somewhat difficult, owing to the amount of culture upon them and the detailed character of the topography, which made progress upon them rather slow. In order to insure their completion during the season Mr. Jennings was, as stated above, sent to aid in completing the Troy sheet, upon the close of his work in the Adirondacks, and with his assistance this sheet was finished. Mr. E. B. Clark was assigned the survey of the Clove sheet, New York, and such part of the Poughkeepsie sheet as the length of the season would permit. The eastern part of the Clove sheet was found to be of a difficult character, owing to forests, and slow progress was made. Still at the end of the season this sheet was completed and one-fourth of the Poughkeepsie sheet lying west of it.

Examination of the work of last season in the anthracite coal regions of Pennsylvania developed the fact that some parts of it had been badly done and that considerable revision was necessary. This took much of the time of Mr. Cummin, who, with Mr. Lambert, continued the work there during the past season. Besides attending to most of this revision, however, Messrs. Cummin and Lambert surveyed three sheets, namely, the Sunbury, Harvey lake, and Millersburg sheets.

On the commencement of work in Connecticut, two years before, it was agreed with the commissioners of the state to include in the survey the location of country houses and to place them upon the maps. This was at variance with the former policy of the Survey, which had restricted culture to that of a public nature. Examination of the Connecticut sheets shows that the work of locating houses had been carried out only partially by certain of the surveyors, owing, possibly, to a misinterpretation of instructions. The omission of houses was quite frequent, and to supply these Mr. Muldrow was sent to Connecticut and kept employed during the entire season. Besides attending to these details, Mr. Muldrow examined and made corrections at a number of points where other criticisms had been made.

SOUTHEASTERN SECTION.

This section was in charge of Mr. Gilbert Thompson. During the past season an area of about 9,000 square miles has been surveyed, completing thirteen atlas sheets, of which seven are on a scale of 1 : 125000 and six on a scale of 1 : 62500. Work has been prosecuted in Maryland, West Virginia, Kentucky, Tennessee, North Carolina, and Alabama, and in addition to the new work in these areas considerable revision has been done, especially in the valley of east Tennessee and northwestern Alabama.

The first party to take the field in this division was that of Mr. L. C. Fletcher, who was, as heretofore, assigned to work in West Virginia. This area lay in the northern part of the state, and comprises what is known as the Sutton and Buckhannon sheets. It is the extremely broken country of the Alleghany plateau, the summits of which stand practically at the same level, while the country at all levels is covered with dense forests. Mr. Fletcher, with three assistants, took the field early in May, and by the middle of the month commenced field work. It was prosecuted actively throughout the season, and early in October he completed the two sheets assigned him. Work was then discontinued, the party broken up, and Mr. Fletcher returned to Washington. Two of his assistants, however, were detailed to Tennessee to reinforce the party of Mr. Barnard.

Mr. Barnard, with three assistants, left for the field in the latter part of May, having been assigned to the survey of the London, Kentucky, atlas sheet, a sheet lying within and near the western border of the Cumberland plateau. This sheet proved to be exceedingly difficult, and it was not until early in September that it was completed. Upon finishing it Mr. Barnard's party was transferred to the Briceville, Tennessee, sheet, lying in the eastern and highest part of the plateau. Upon the close of Mr. Fletcher's work Mr. Barnard's party was reinforced by two of Mr. Fletcher's assistants, and by their aid the sheet was completed early in December. This involved not only the survey of about half its area but a complete revision of nearly all of the remainder.

Mr. Merrill Hackett, with three assistants, left for the field about the middle of June, having been assigned to the survey of two sheets in western North Carolina, known as the Statesville and Yadkinville sheets. During the season, which for him extended well into November, he completed these sheets and also an area about the town of Salisbury.

Mr. Louis Nell, with three assistants, was charged with the completion of the McMinnville sheet in Tennessee, after which he devoted his energies and those of his party during the remainder of the season to the survey of the Black Warrior coal field in northwestern Alabama. Besides completing the McMinnville sheet he surveyed and completed the Jasper sheet and part of that lying south of it.

During the spring and early summer Mr. A. E. Murlin was engaged in field work about the head of Chesapeake bay for the purpose of completing, with the aid of the work of the U. S. Coast and Geodetic Survey, a number of atlas sheets lying in that neighborhood and down the eastern shore of the bay. In this way the material was obtained for finishing six additional atlas sheets.

During this season extensive revisionary surveys were made. Mr. Charles E. Cooke was engaged in examinations and corrections upon the Loudon, Kingston, Cleveland, and Murphy sheets, in the southern part of the Tennessee Valley. Mr. Hersey Monroe examined and revised areas in the Winchester, Romney, Luray, and Woodstock sheets, in the northern part of Virginia, and on the Wytheville sheet, in the southern part of that state. Early in August Mr. R. L. Longstreet was sent to the field to revise the northern portion of the Estillville sheet. In the latter part of the season he was engaged in revisionary surveys on the Greenville, Estillville, and other adjoining atlas sheets.

During the winter, work was prosecuted in Florida, but to a limited extent only, in the way of preparation for extensive operations during the succeeding winter. This work was in charge of Mr. H. L. Baldwin, and consisted in running primary traverse lines for purposes of control. Two hundred and thirty miles of line were thus run, connecting Gainesville with Tampa on the western coast, and from Gainesville northeastward in such a way as to control the greater part of the phosphate region, which it is expected to survey during the coming winter.

CENTRAL SECTION.

This section has remained in charge of Mr. J. H. Renshawe. Work has been prosecuted in southern Wisconsin, Illinois, Kansas and Arkansas. The area surveyed was 12,500 square miles, completing twenty-one atlas sheets, of which eleven are upon a scale 1 : 62500 and ten upon a scale 1 : 125000.

Work in Wisconsin was resumed in May by one party under Mr. Van H. Manning. It was prosecuted actively and was closed in November. During the season Mr. Manning surveyed six atlas sheets, lying in a strip along the southern border of the state, extending from near Lake Michigan westward to about the longitude of Madison. The area surveyed is estimated at 1,350 square miles.

Work was resumed also in Illinois in May by Mr. Harrison with a small party. During the season this party completed five atlas sheets, extending the surveyed area down the course of the Illinois river. He closed work in November. The area surveyed is estimated at 1,100 square miles.

Work was resumed in Kansas early in June, and in order to push the survey of this area with greater rapidity than heretofore, two parties were placed in the field, one in charge of Mr. R. M. Towson, the other under Mr. W. J. Peters, who has for several years been engaged on the work in Iowa. Work was prosecuted by both these parties energetically and with good effect, and the close of the season, in November, found eight atlas sheets completed, comprising 8,000 square miles, of which about half should be credited to each party. This surveyed area lies in the northern part of Kansas between the ninety-eighth and one hundredth meridians.

As heretofore, the work in Arkansas was placed in charge of Mr. H. B. Blair. Owing to the pressure of office work, Mr. Blair was unable to take the field until early in July. The first work of his party consisted in the completion of the Little Rock sheet, a small part of which had been surveyed during the previous season. After this Mr. Blair surveyed the Yellville sheet, which comprises a portion of the complicated and densely forested region north of the Arkansas river. Work was closed in December, and the area surveyed by this party was practically 2,000 square miles.

Throughout the season this section has maintained a party under Mr. G. T. Hawkins for the execution of primary control. During May and June this party was engaged in running primary transverse lines in Cherokee and Smith counties, Tex., for the control of the area surveyed in those counties two years ago by Mr. Harrison. The remainder of the season was devoted by Mr. Hawkins to the extension of triangulation in northwestern Arkansas. A chain of figures was carried westward along the northern border of the state to the neighborhood of its northwestern corner, thence southward to the Arkansas river, connecting there with the initial work done in the state. The connection made showed that the accumulated error of this long circuit from Little Rock to the northern boundary of the state, thence to the northwestern corner and southward to the neighborhood of Fort Smith, was not of sufficient magnitude to be worth considering for map purposes.

ASTRONOMIC AND COMPUTING SECTION.

This section has been in charge of Mr. S. S. Gannett. Some fieldwork was done by Mr. Gannett in the early part of the season in Pennsylvania in the way of multiplying points from the stations of the triangulation of the U. S. Coast and Geodetic Survey. The greater part of his work, however, has consisted in making final reductions of traverse lines in Texas and Florida, and the triangulation in Arkansas. Considerable attention has been paid to the preparation of tables for the reduction of vertical angles and other purposes.

INSTRUMENTS.

The instrument shop, as heretofore, has been in charge of Mr. Edward Kübel, at first with four assistants, but later, upon the reduction of the force, with two assistants only. The work done in the shop has consisted of little more than the repair and adjustment of the instruments in use by the survey, the number of which is very large and is constantly increasing. Still Mr. Kübel has found time during the year to manufacture six telescopic alidades of the most modern type, and has nearly completed an 8-inch theodolite for primary work.

Respectfully submitted.

HENRY GANNETT,
Chief Topographer.

Hon. J. W. POWELL,
Director U. S. Geological Survey.

REPORT OF MR. A. H. THOMPSON.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
TOPOGRAPHIC DIVISION WEST OF THE ONE HUNDREDTH MERIDIAN,
Washington, D. C., June 30, 1892.

SIR: I have the honor to submit the following report of the work of this division for the past year.

On account of field work commencing before the end of the fiscal year, and the impossibility of separating the amount of work actually done before July 1, 1891, from that of the succeeding year, my report and work includes only that done between May 1, 1891, and May 1, 1892.

LOCATION OF WORK.

Work was prosecuted during the time stated above in the states of California, Colorado, Idaho, Kansas, Montana, Nevada, South Dakota, Texas, and Wyoming, and the territories of New Mexico and Utah, and in the office at Washington, D. C., in accordance with plans submitted to and approved by you.

GENERAL ORGANIZATION.

For the convenience of supervision and administrative management, seven sections for the prosecution of work were organized at the beginning of the year. Upon the passage of the sundry civil bill, August 30, 1890, and in accordance with the provisions of that act requiring that half of the gross appropriations for topographic work be spent west of the one hundredth meridian, two additional sections were formed, making seven sections in all, the gold belt region of California and the state of Nevada constituting the first, Southern California the second, Colorado, South Dakota, and Wyoming the third, Idaho the fourth, Montana the fifth, Texas the sixth, and the mining district of Aspen, in Colorado, the seventh.

PERSONNEL.

CALIFORNIA-NEVADA SECTION.

Mr. E. M. Douglas was assigned to the charge of the California Gold-Belt Section, assisted by Messrs. A. F. Dunnington, R. H. McKee, R. H. Chapman, topographers; H. E. C. Feusier and P. V. S. Bartlett, assistant topographers, as assistants in charge of parties.

The assignment of Mr. Douglas continued until September, 1891, when he was directed to exchange stations with Mr. W. D. Johnson, in charge of the Colorado, South Dakota, and Wyoming Section, the assistants remaining the same.

COLORADO–SOUTH DAKOTA–WYOMING SECTION.

Mr. Willard D. Johnson, topographer, was assigned to the charge of the Colorado–South Dakota–Wyoming Section, assisted by Messrs. C. H. Fitch, R. C. McKinney, C. C. Bassett, W. S. Post, R. B. Marshall, topograpers; A, C. Barclay, R. A. Farmer, S. P. Johnson, and C. H. Stone, assistant topographers, in charge of parties.

ASPEN SECTION, COLORADO.

Mr. Morris Bien, assisted by Mr. W. B. Corse, was first assigned to the survey of reservoir sites in Utah and Idaho, and upon the completion of this work was placed in charge of the work in the Aspen mining district, Colorado.

IDAHO SECTION.

Mr. W. T. Griswold, topographer, was assigned in charge of the Idaho Section, assisted by Messrs. E. T. Perkins, topographer; W. P. Trowbridge and L. B. Kendall, assistant topographers, in charge of parties.

MONTANA SECTION.

Mr. Frank Tweedy, topographer, was assigned to the charge of the Montana Section, assisted by Messrs. R. B. Marshall, topographer, and A. C. Barclay, assistant topographer, in charge of parties.

TEXAS SECTION.

Mr. R. U. Goode, geographer, was assigned to the charge of the Texas Section, assisted by Messrs. H. L. Baldwin, H. S. Wallace, R. O. Gordon, C. F. Urquhart, W. H. Herron, topographers, in charge of parties, and Perry Fuller and E. McL. Long, assistant topographers.

PARTIES AND ORGANIZATION FOR FIELD WORK.

In the Gold Belt Section of California one triangulation and four topographic parties were organized.

In the Southern California Section one triangulation and two topographic parties were organized.

In the Colorado–South Dakota–Wyoming Section one level and one triangulation and six topographic parties were organized.

In the Idaho Section one triangulation and two topographic parties were organized.

In the Montana–Texas Section one triangulation, one level, and three topographic parties were organized.

In the Montana Section one triangulation and two topographic parties were organized.

In the Aspen Section, Colorado, two topographic parties were organized.

The field work of these parties being as heretofore in a sparsely settled region, it was usually necessary to subsist them in camps. The arrangements for this purpose were nearly the same in all localities; each party employing, in addition to the regular appointed assistants, one or two persons as traverse or rod men, one laborer, one cook, and one teamster, using as means of transportation one large four-mule team and wagon for camp equipage and supplies, and buckboards or saddle animals for persons engaged in map work.

ATLAS SHEETS.

In all sections the work proceeded when practicable by the atlas sheet areas according to the general system adopted by the U. S. Geological Survey, and were bounded as far as practicable by the half or quarter degree lines of latitude and longitude.

The field work was usually done on twice the scale intended for publication, the relief being represented by contour lines having equal vertical intervals, but differing on different sheets and sometimes on the same sheet.

The following table shows the locality, the scale of field work, the contour interval, and the area surveyed during the year:

Locality.	Scale field work.	Contour interval.	Square miles surveyed.
		Feet.	
California Gold Belt	1 inch=1 mile	100–50	2,600
California Southern	1 inch=1 mile	100–50–25	700
Colorado	1 inch=1 mile	100–50	1,800
Colorado, Aspen	1 inch=1 mile		10
Idaho	1 inch=1 mile	100–50	3,540
Montana	1 inch=1 mile	50–100	3,000
Nevada	1 inch=1 mile	100	3,180
South Dakota	1 inch=1 mile		1,500
Texas	1 inch=1 mile	50	10,800
Wyoming	1 inch=1 mile	50	1,800
Total			28,930

In addition to topographic map work the Aspen Section, Colorado, has surveyed and reported for segregation from the public domain thirteen reservoir sites lying within the state of Idaho and the territory of Utah.

DETAILED REPORTS BY SECTIONS.

CALIFORNIA-NEVADA SECTION.

One triangulation and four topographic parties were organized for work in this section, viz: one at Taylorsville, California; three at Ione, California, and one at Keeler, Nevada. The party organized at Taylorsville was placed in charge of Mr. A. F. Dunnington and directed to survey certain areas in the vicinity of that place. This work being for special geological purposes was not done upon the regular atlas sheet areas, but three irregular sheets, embracing 250 square miles, were completed. Work upon this area was commenced May 15, 1891, and com pleted August 15.

Mr. Dunnington's force was then reinforced by the addition of Mr. R. B. Marshall, topographer, a second party organized, and both, under Mr. Dunnington's supervision, were directed to commence work in the vicinity of Grass Valley and Nevada city, California, on a scale of 1 inch=1,200 feet. An area of 42 square miles, embracing all of the important mines of that region, was completed November 15.

The party was then disbanded and directed to report at Washington, D. C., for office work.

One triangulation and two topographic parties under the charge of Mr. H. E. C. Feusier, Mr. R. H. McKee, and R. H. Chapman, respectively, were organized at Ione, June 1.

Mr. Feusier was directed to extend the trigangulation to the west and south of previously mapped areas in the Gold-Belt region. The parties of Messrs. McKee and Chapman were directed to extend topographic work over the same area. These parties completed the work assigned them November 15. They were then disbanded and directed to proceed to Berkley, California, to prepare the final drawing of their atlas sheets for the engraver.

The party at Keeler, Nevada, was organized under the charge of Mr. P. V. S. Bartlett, and directed to coöperate with parties connected with the biological survey of the vicinity of Death Valley by the Agricultural Department. This party completed the work assigned it and was disbanded September 1. Mr. Bartlett then proceeded to Fort Custer, Montana, where he was given charge of one of the parties engaged in the work of that section.

Mr. Douglas was engaged in the general supervision and direction of the work of this section until September, 1891, when he assumed charge of the Colorado–South Dakota–Wyoming section, being succeeded in the general supervision of this section by Mr. Willard D. Johnson.

SOUTHERN CALIFORNIA SECTION.

One triangulation and two topographic parties for the work of this section were organized at Oceanside May 25, 1891, Mr. Davis taking immediate charge of the triangulation in addition to his supervision work, and Messrs. Lippincott and Ahern, respectively, the topographic parties.

Work was prosecuted to the east and south of Oceanside until the middle of November, when the parties were disbanded and reported at Los Angeles for office work.

COLORADO–SOUTH DAKOTA–WYOMING SECTION.

Parties for work in this section were organized at Denver, Colorado, Fort Steele, and Buffalo, Wyoming, and Rapid City, South Dakota.

The party organized at Denver was placed in charge of Mr. S. P. Johnson, and directed to work in the region about South Platte canyon. Work was commenced June 1 and continued until Nov. 1. The party was then disbanded and directed to proceed to Washington, D. C., for office work.

The party organized at Fort Steele, Wyoming, was placed in charge of Mr. C. C. Bassett, and directed to work in the drainage basin of the North Platte River. Work was commenced June 1 and continued until Nov. 15, when the party was disbanded, and Mr. Bassett directed to report at Washington, D. C., for office work.

The party organized at Buffalo was placed in charge of Mr. R. C. McKinney, and directed to work in the drainage basin of the Tongue River. This party commenced work June 15 and was disbanded November 1.

Two parties were organized at Rapid City, South Dakota, and placed in charge of Mr. C. H. Fitch and Mr. R. C. Farmer respectively. Work was commenced June 1 and carried on in the vicinity of Rapid City and Deadwood until November 15, when the parties were disbanded, and Messrs. Fitch and Farmer directed to proceed to Washington, D. C., for office work.

Mr. Willard D. Johnson was engaged in the direction and supervision of the work of this section until September, 1891, when he was directed to assume charge of the Gold-Belt region of California, being succeeded in the general supervision of this section by Mr. E. M. Douglas.

IDAHO SECTION.

One triangulation and two topographic parties were organized for the work of this section, the first being under the charge of Mr. Griswold, in addition to his work of supervision, the latter in the charge of Messrs. Perkins and Trowbridge respectively.

The party under Mr. Griswold extended the triangulation and control work south and east of the previously surveyed area.

The topographic party under charge of Mr. Perkins was engaged in work north and east of Boisé.

The party under Mr. Trowbridge was engaged in the early part of the season in work on the Snake river plain south and west of Boise, but later in the season was transferred to the mountains north of that place.

These parties were disbanded November 15, and Mr. Griswold directed to report, with his assistant, at Boisé for office work.

MONTANA SECTION.

One triangulation and two topographic parties were organized for the work of this section at Custer Station, Montana, on May 15, 1891, Mr. Tweedy, in addition to the charge of the section, having immediate direction of the triangulation, and Messrs. Marshall and Barclay of the togographic parties.

Work was prosecuted along the lower courses of the Big Horn and Little Horn rivers until November 15, when the parties were disbanded and reported at Washington, D. C., for office work.

Some change was made in the personnel of this section during the season, Mr. Marshall being relieved of the charge of his party August 15 and directed to report to the Gold-Belt section of California for detailed work near Nevada City, California, and Mr. P. V. S. Bartlett, who had been engaged in work in Nevada, was directed to take charge of Mr. Marshall's party.

TEXAS SECTION.

Parties for the prosecution of this work were organized in two subsections as follows:

The eastern subsection, which consisted of one triangulation party, under Mr. Urquhart and two topographic parties under Messrs. Gordon and Wallace respectively, and one level party under Mr. Fuller, were organized at San Angelo May 15, 1891.

The western subsection, consisting of one triangulation and one topographic party, was organized at El Paso June 1, Mr. Goode taking immediate direction of the triangulation party in addition to his works of supervision, and Mr. Herron of the topographic.

Work in the eastern subsection was prosecuted west of the one-hundredth meridian and south of latitude 33°.

Work in the west subsection was prosecuted east and south from El Paso.

Field work was continued in both subsections until November 15, when the parties were disbanded and directed to report at Washington, D. C., for office work.

ASPEN SECTION, COLORADO.

The work of this section was commenced May 1 by the survey of thirteen reservoir sites situated in Idaho and Utah. On the completion of this work Mr. Bien, with his assistant, Mr. Corse, was directed to proceed to Aspen, Colorado, and commence the survey of that mining district on a scale of 1,000 feet=1 inch.

This work was continued until November 15, when the party was disbanded and directed to proceed to Washington, D. C., for office work. In addition to the survey for a topographic map, a large amount of data relating to the under-ground working of the mines was collected.

METHODS ON FIELD WORK.

The methods of field work in all sections were essentially the same, though the details of execution varied with scale, contour interval and local conditions.

The general method may be summarized as consisting in the determination of linear distances, of relative altitudes, and the conventional representation of topographic forms and cultural features.

In the Gold Belt and southern sections of California, and in Colorado, the linear distances were derived from the triangulations depending upon the stations of the transcontinental triangulations of the U. S. Coast and Geodetic Survey. In Idaho, Montana, Texas, Wyoming, and South Dakota linear distances were derived from systems of triangulation expanded from bases measured by the U. S. Geological Survey.

Preliminary base lines were measured at Aspen, Colorado; Custer station, Montana; Forts Steele and Dayton, Wyoming, and Rapid city, South Dakota. These lines were carefully measured by a well tested steel ribbon, 300 feet in length, and served admirably the purposes for which they were intended. In the detailed work at Aspen, Colorado, and in the work near Grass Valley, California, great use was made of the stadia.

Plane-table traverses, using the compass for directions and some form of odometer or stadia rod for distances, controlled by frequent references to the stations in the triangulation, were used for intermediate locations in addition to plane-table work from stations, and thus the whole area of every atlas sheet was covered by a network of carefully determined linear lines and located points.

The altitudes of all located points in the areas surveyed were determined by horizontal or angular leveling. The aneroid barometer was used to some extent for intermediate altitudes. In all cases a number of accurately determined bench marks were located on each atlas sheet, and to these all other altitudes were referred.

The representation of topographic features was secured by sketching from stations occupied in both plane-table and traverse work. This sketching was done in contours, having a prescribed vertical interval.

OFFICE WORK.

Immediately on the disbandment of the field parties, all persons belonging to the permanent force were directed to report for office work in the preparation of the final maps for the engraver.

On account of the distance from the home office in Washington, D. C., the parties working in the Gold Belt and southern sections of California and in Idaho, were permitted to establish temporary offices for the completion of their maps. That of the Gold-Belt section was established at Berkley California, where the use of rooms was tendered by the California State University.

The parties working in the southern section of California reported at Los Angeles, where suitable quarters were secured.

The parties in the Idaho section reported at Boisé, where suitable rooms were found.

The parties of all the other sections reported at Washington, D. C. The office force both at Washington and in the subordinate field offices was organized into the same sections as in the field, giving to each person who had charge of a field section charge of the office work of that section, and assigning to each person the construction of the maps of the area in which he had done field work, thus securing in the final drawing all knowledge obtained by personal observation in the field.

The following table shows the locality of each atlas sheet prepared for the engraver, the scale upon which the final drawing was made, the scale of publication, and the contour interval:

State.	Name.	Scale drawing.	Scale publication.
California gold belt	Grass Valley	1,000 feet = 1 inch	1,200 feet = 1 inch.
	Nevada City	1,000 feet = 1 inch	1,200 feet = 1 inch.
	Banner Hill	1,000 feet = 1 inch	1,200 feet = 1 inch.
	Brunswick Mine	1,000 feet = 1 inch	1,200 feet = 1 inch.
	Indian Valley	1 mile = 1 inch	1:82,500.
	Genessee	1 mile = 2 inches	1 mile = 2 inches.
	Taylorville	1 mile = 2 inches	1 mile = 2 inches.
	Sonora	1½ miles = 1 inch	1:125,000.
	Big Trees	1½ miles = 1 inch	1:125,000.
	Lodi	1½ miles = 1 inch	1:125,000.
California, Southern	Escondido	1½ inches = 1 mile	1:62,500.
	El Cajon	1½ inches = 1 mile	1:62,500.
	Oceanside	1½ inches = 1 mile	1:62,500.
Colorado	Castle Rock	1 inch = 1 mile	1:125,000.
	Platte Canyon	1 inch = 1 mile	1:125,000.
	Aspen (special)	800 feet = 1 inch	800 feet.
	Aspen (mine sheets)	200 feet = 1 inch	1:125,000.
Idaho	Nampa	1½ miles = 1 inch	1:125,000.
	Squaw Valley	1½ miles = 1 inch	1:125,000.
	Bear Valley	1½ miles = 1 inch	1:125,000.
	Rocky Bar	1½ miles = 1 inch	1:125,000.
Montana	Huntley	1½ miles = 1 inch	1:125,000.
	Fort Custer	1½ miles = 1 inch	1:125,000.
	Xavier Mission	1½ miles = 1 inch	1:125,000.
	Rosebud	1½ miles = 1 inch	1:125,000.
South Dakota	Deadwood	1½ miles = 1 inch	1:125,000.
	Rapid City	1½ miles = 1 inch	1:125,000.
	Hermosa	1½ miles = 1 inch	1:125,000.
Texas	Roby	1½ miles = 1 inch	1:125,000.
	Sweetwater	1½ miles = 1 inch	1:125,000.
	McKavett	1½ miles = 1 inch	1:125,000.
	Rock Springs	1½ miles = 1 inch	1:125,000.
	Nueces	1½ miles = 1 inch	1:125,000.
	Brackettville	1½ miles = 1 inch	1:125.000.
	El Paso	1½ miles = 1 inch	1:125,000.
	Fort Hancock	1½ miles = 1 inch	1:125,000.
	Salt Basin	1½ miles = 1 inch	1:125,000.
	Sierra Blanca	1½ miles = 1 inch	1:125,000.
Wyoming	Fort Steele	1½ miles = 1 inch	1:125,000
	Dayton	1½ miles = 1 inch	1:125,000

By May 1, 1892, all the final drawings of maps of the areas surveyed by each of the sections were completed ready for the engraver.

In addition to the maps designated, plats on the scale of 2 inches= 1 mile were made by the Aspen, Colorado, section of the 13 reservoir sites surveyed. These plats show the location selected for the dam, the boundary line of water surface at the given height of dam, its location on the subdivisions of the general land survey, the areas included being designated by the township, range, section, and subdivision of sections necessary to be segregated for the reservation of the site.

With these plats were also prepared schedules describing in terms of the general land survey, the areas included in each reservoir site, and the present condition of the title to these lands, so far as shown by the records of the General Land Office.

Upon the completion of the final drawings of the atlas sheets surveyed during the season and the preparation of the plats, descriptions, and schedules of reservoirs, the permanent force of each section was directed to prepare for the field work of the ensuing year.

DISBURSEMENTS OF MONEY.

The disbursement of money for the Division of Topography west of the one hundredth meridian was in charge of Mr. James W. Spencer for the entire year, and was made from Washington, D. C., and offices in the field.

I am, very respectfully, your obedient servant,

A. H. Thompson,
Geographer in charge.

Hon. J. W. Powell,
Director U. S. Geological Survey.

REPORT OF MR. G. K. GILBERT.

Department of the Interior,
U. S. Geological Survey,
Geologic Branch,
Washington, D. C., June 30, 1892.

Sir: I have the honor to submit the following report of the work of the Geologic Branch for the fiscal year ending to-day:

No changes have been made in the general organization. With minor exceptions, each member of the corps has carried forward during the year work on which he was previously engaged. Accounts of this progress and of such minor changes as have occurred will be found in the succeeding paragraphs of this report, and especially in the reports of the chiefs of divisions appended hereto.

Continued attention has been given to the subject of geologic cartography. In order to depict upon maps the areas occupied by the several geologic formations of the districts represented, it is necessary not only to delineate the boundaries of the formation areas, but to distinguish the whole extent of each area by a special notation. The number of ways in which this can be accomplished is great, and a volume might be devoted to descriptions of the methods which have been actually employed in the geologic maps already published in various lands. The primary elements of the notations embodied in these methods may be broadly characterized as patterns and colors. In maps prepared by hand, color distinctions are more economically employed; in printed maps discrimination by means of pattern is more economical. It is a general fact that a notation dependent on color distinctions is more easily read and thus more advantageous to the user than a notation dependent on patterns; but this general fact is qualified by certain conditions depending on color blindness and on the use of artificial lights, and it is subject to the limitation that only a moderate number of color differences can be clearly discriminated on the same map.

In the geologic atlas of the United States, comprising several thousands of sheets, it will be necessary to represent several hundreds of distinct formations, but only a small number of these formations occur within the area represented by any single atlas sheet. If a special notation were devised for each formation, a notation consisting of a color or a pattern or of a specific combination of color and pattern, the resulting system would be cumbrous and bewildering and its development would be peculiarly difficult because at the initial stage of map publication only a portion of the formations of the country are recognized and discriminated. If no general notation were attempted and the notation for each sheet were separately devised, the most effective results could be attained on the individual sheets, but it would be impracticable to group sheets together and the reader would gather no meaning from any sheet until he has studied its legend. In the one case the cartographic alphabet would be so cumbrous that none would learn it; in the other, a new alphabet must be learned for each sheet. After mature deliberation the Director determined on a system in which both these difficulties are measurably avoided by the assignment of certain well-defined classes of notational devices to certain classes of formations, but without the assignment of specific devices to specific formations. To the fossiliferous clastics, the formation of the Pleistocene, the crystalline schists, and the igneous rocks are assigned severally four groups of patterns. In the representation of the formations of each of these classes the entire gamut of colors is permitted, with the special proviso that in the case of the fossiliferous clastics color be used to designate certain of the major divisions of geologic time. The system thus gives classific meaning to four broad distinctions of pattern, readily remembered, and also to ten distinctions of color, which for mnemonic purposes are arranged in the order of the spectrum. All minor distinctions among formations are to be represented by specific patterns or by specific patterns in connection with specific colors, and these are to be chosen independently in the several geologic districts. It is thus uniform with reference to the broad features of classification and plastic with reference to details, which vary from district to district in ways which can not be anticipated. This system is set forth in the Tenth Annual Report of the Director, but it is set forth only in outline and its application in the actual production of atlas sheets has raised many practical questions whose consideration and determination have demanded not only much discussion and study but a large amount of experimental work. It is not necessary to enumerate these questions, but it will suffice to say that they have been solved or are being solved one by one through the patient efforts of my colleagues, and that the close of the year finds the elaboration of the cartographic system and the methods of its production well advanced. In this work many members of the branch have aided by criticism and suggestion. Mr. Bailey Willis has at my request contributed a large amount of study as well as executive attention to detail, and experimentation has been carried forward by the Division of Illustrations, under the direction of Mr. Gill, and especially by the Engraving Division under the direction of Mr. Kübel.

WORK OF THE GEOLOGIC DIVISIONS.

The Atlantic Coast Division, under Prof. N. S. Shaler, having previously mapped the surface geology of Massachusetts, with the exception of a limited area covered by the Archean Division, has been largely occupied this year with the continuance of office work for the preparation of these sheets for publication. A certain amount of supplementary field work has also been accomplished, especially for the delineation of the drumlins, which were not everywhere discriminated in the original survey. New work of a similar character has also been carried over portions of Maine, Connecticut and Rhode Island, and it has been completed for twelve sheets. Prof. Shaler has also prepared, on the basis of his broad acquaintance with our Atlantic coast, acquired chiefly through studies under the auspices of the U. S. Coast Survey and the U. S. Geological Survey, an important paper on the geological history of natural harbors, which appears in this volume, and in connection with its preparation he did some supplementary field work on the southern Atlantic coast.

The Archean Division, in charge of Mr. R. Pumpelly, has continued the mapping of the metamorphic and crystalline formations in central and western Massachusetts, northern Connecticut, and a contiguous belt of eastern New York, and it has also carried structural studies northward into central Vermont. Generally speaking, the degree of metamorphism and the consequent difficulty of the classification of formations increase in this region from west to east. In New York, not far from the Massachusetts boundary, formations are somewhat readily classified by means of fossils. In central Massachusetts such means are not available, and the determination of correspondence among the formations of the two districts was accomplished only after elaborate studies along the intermediate zone in western Massachusetts. In a similar way it is anticipated that a zone of intermediate character in central Vermont will serve to carry trustworthy interpretation from the fossiliferous formations of an adjacent district in New York to the more crystalline district of eastern Vermont and New Hampshire.

In the New Jersey Division, likewise in charge of Mr. Pumpelly, work is carried on in cooperation with the state geological survey, and under this arrangement the study of the metamorphic and crystalline rocks in the northern part of the state falls to the share of the national Survey. The work is under the immediate direction of Prof. J. E. Wolff, and is conducted by the methods developed in the Archean Division. Some time was given to general studies having the nature of reconnoissance, but areal work was also instituted at several centers.

The work of the Potomac Division, in charge of Mr. W. J. McGee, pertains to the level formations of the plain bordering the Atlantic and Gulf coasts from New Jersey to Florida. During the year rapid progress has been made in the preparation of geologic atlas sheets for districts in Maryland and Virginia, and similar work has been begun in New Jersey in cooperation with the state survey. The necessary topographic sheets are not yet available for the more southerly portions of the coastal plain, but much has been there accomplished in the discrimination and correlation of formations. This work has been carried forward in cooperation with the state geological surveys of North Carolina and Alabama, and also with the aid of Prof. E. W. Hilgard, formerly state geologist of Missouri and Louisiana.

The energies of the Appalachian Division, in charge of Mr. Bailey Willis, have, as heretofore, been directed chiefly to the mapping of the intricate outcrops of Paleozoic formations disturbed by folding and faulting. For the solution of certain special problems of difficulty the cooperation of Mr. Walcott, chief paleontologist, has been secured. An arrangement has also been made for cooperation by Prof. H. D. Campbell, of Lexington, Virginia, who has devoted his leisure for several years to the geology of his neighborhood. That the Survey may avail itself of the results of this private work, it has been arranged that he extend his local studies so as to include a certain definite rectangular area and plat the formation boundaries on topographic atlas sheets.

For the purpose of aiding in the elucidation of problems of structure, and especially in truly conceiving the attitudes and relations of those portions of the various formations which are concealed beneath the surface, Mr. Willis has conducted, during the past two years, a series of laboratory experiments in which specially grouped laminæ of various substances arranged to represent in miniature the rock formations of the Appalachian district were subjected to deforming forces. The results of this work are set forth in one of the accompanying papers of this volume.

In Florida the season for geological work is necessarily in the cooler months, and it thus happens that for the Florida Division the fiscal year to which this report pertains covers a complete field season. This was devoted by Mr. George H. Eldridge and his assistants to the continued mapping of the geologic formations, and to a broad study of the phosphatic deposits, including the mode of origin of the various kinds of phosphate rock and the various conditions affecting their distribution. Attention was also given to the methods of mining, handling, and treating the ore, and these will be described in the final report.

The Lake Superior Division, in charge of Prof. C. R. Van Hise, continued the mapping of crystalline formations in the region immediately south of Lake Superior. As heretofore the progress of the work has been necessarily slow on account of the concealment of the rocks by glacial drift and by swamps, and also because but a small portion of the region has been freed of its dense forests. Progress is further impeded by the metamorphic condition of the rocks, which renders discrimination by means of general appearance both difficult and precarious, so that it is found necessary to supplement the field work by extensive laboratory investigations involving the preparation of numerous thin sections and their study with the microscope. Nevertheless the great economic value of the formations of this region fully justifies the pains and expense bestowed upon it, and there is no district in which the work of the Survey yields more promptly to the people its tribute of material advantage.

The field work of the Glacial Division, in charge of Prof. T. C. Chamberlin, has included great progress in the mapping of the numerous moraines of Ohio, Indiana, Illinois and Wisconsin. This work is carried forward with the aid of general maps of smaller scale than those prepared by the Geological Survey, and is an important preliminary to the more detailed delineation of glacial formations and associated soils upon the atlas sheets. In central Wisconsin progress has been made in final mapping upon atlas sheets, and similar work has been carried on in New Jersey in cooperation with the state geological survey. The division has also devoted much time to the preparation of reports on branches of the general investigation already completed, and several of these will soon go to press.

The investigation of the zinc and lead deposits of southwestern Missouri by Mr. W. P. Jenney was continued, field work being completed and laboratory and office work well advanced. As the conclusions attained appear to have important bearing on all the zinc and lead mining industries of the Mississippi valley, it seemed advisable to supplement field work in the specific area by brief visits to other districts. Excursions were accordingly made to the mining districts of southeastern Missouri, and to those of Dubuque, Iowa, Galena, Illinois, and Mineral Point, Wisconsin, and the deposits in these districts were examined so far as was necessary to determine their degree of similarity to the deposits of southwestern Missouri.

In Montana a short field season enabled Mr. A. C. Peale to complete the mapping of the Three Forks sheet, after which he returned to Washington and resumed statistical work on the mineral and thermal waters of the United States, preparing for the division of mineral statistics papers on the mineral waters of the country for the years 1889, 1890 and 1891.

The principal work of the Yellowstone Park Division, under Mr. Arnold Hague, has been the preparation and publication of reports. Mr. Hague's monograph on the geology of the Eureka District, Nevada, was sent to the printer early in the year. A number of minor reports pertaining to the Yellowstone Park and the Livingston atlas sheets have also been published during the year, and substantial progress has been made in the preparation of the final report on the geology of the National Park. In the field the survey of the Livingston sheet was continued, and a contiguous area was examined with special reference to the character and extent of its coal fields.

The Colorado Division, in charge of Mr. S. F. Emmons, has been occupied chiefly with problems of mining geology. For the purpose of utilizing still further the new exposures opened in the prosecution of mining work an additional visit was made to Leadville, Colorado. Other examinations of the nature of reconnoissance were made in the Butte, Creede and Aspen districts, and in the last mentioned a plan was developed for systematic investigation. Through the cooperaof the Topographic branch a detailed map was prepared of a limited area, and it is proposed to institute systematic geologic work at an early day. These field operations consumed a small portion of the time of the division, the remainder being devoted to office work, chiefly the preparation of reports on surveys previously completed.

The Cascade Division, in charge of Mr. J. S. Diller, continued its general work of mapping the distributions of formations, but gave much time to an elaborate local study calculated to facilitate the correlation of the formations of the district with those of other regions. This local study was in the vicinity of Taylorsville, California, where a topographic map had been prepared on a large scale and where it was already known that many of the rocks were fossiliferous. The stratigraphy and structure were determined and mapped with great detail, and by the aid of Prof. Alpheus Hyatt, of the Paleontologic branch, large collections of fossils were made at numerous horizons. These served to determine the geologic age of the sedimentary formations of the local series and will be of great aid in the future areal work of the division.

During May and June of this year a reconnoissance has been carried over southern Washington, and a local study has been made of the ancient lake beds which have been found to yield artesian water in one of eastern valleys of the state. A report upon this investigation, which was instituted largely for the sake of immediate economic results, will soon be prepared.

The California Division, in charge of Mr. G. F. Becker, has continued the mapping upon atlas sheets of the formations of the gold belt, and like the Cascade Division, has made special efforts to secure fossils for the determination of the age of formations. At the same time a study has been made of the laws of dynamic action under which the granites and schists of the Sierra Nevada have received their present structure and acquired their metaliferous deposits. Beside thus continuing its principal work in the Sierra Nevada, the division has instituted a local survey covering the district about San Francisco, and in this it has secured the aid of Prof. A. C. Lawson, of the University of California.

In previous reports account has been given of joint excursions by members of different divisions of the Survey for the purpose of securing to each the advantage of personal familiarity with phenomena of special significance observed by others and thus promoting the unity of the whole work. During the year there have been four joint excursions of this character, in addition to cooperative field work by members of the Paleontologic and Geologic branches. Early in July Prof. Van Hise joined Dr. Peale in Montana and reviewed with him the Algonkian geology of the Three Forks sheet. In the following month Messrs. Van Hise and Pumpelly studied in company the type localities of the Huronian and Laurentian systems. At about the same time there was organized a party comprising Mr. McGee, of the Potomac Division; Mr. L. F. Ward, of the Paleontologic Branch; Mr. R. T. Hill, temporarily connected with that branch; and Profs. E. W. Hilgard, James M. Safford, E. A. Smith, and J. A. Holmes, now or formerly state geologists of Mississippi, Tennessee, Alabama and North Carolina. The party thus constituted comprised geologists who had studied the series of coastal plain deposits in different districts, where their constitution was variously affected by local conditions. Naturally, the conclusions reached were not entirely harmonious, and it was the purpose of the expedition to enable each observer to understand more fully the phenomena studied by the others, so that, from a broad and common view of the facts, there might, if possible, result a single and common interpretation. To this end the party visited numerous localities in Mississippi, Louisiana and western Tennessee, and afterwards separated into two divisions, which severally traversed Alabama and Texas. While an entire accordance was not attained, the joint observation led to modifications of opinion tending in the direction of harmony. Later in the season Messrs. Chamberlin and Salisbury, of the Glacial Division, and Mr. McGee, of the Potomac Division, visited a series of localities in Georgia, Alabama, Mississippi and Tennessee for the purpose of examining in company certain formations supposed to have a common bearing on their respective subjects of study.

SPECIAL AND TEMPORARY INVESTIGATIONS.

In the general organization of the branch the work of mapping formations is divided by districts, a corps of geologists constituting a division being assigned to each district and working continuously for a series of years. To other divisions are assigned local mining investigations not involving the preparation of extensive maps; and a single division, the Glacial, carrying forward a study of a widespread group of formations overlying all others, overlaps in its field of operations the districts of several divisions. Beside these greater units of work, occupying each a period of several years, the Survey undertakes from time to time less extensive works requiring shorter periods and smaller corps, and these are to a considerable extent carried on by experts who are not permanent members of the organization. Certain of these minor investigations are so related to the greater undertakings of the Survey that their supervision is advantageously assigned to geologists in charge of divisions, but in the case of others such assignment appears unadvisable. The most important of such temporary undertakings was placed in my charge before creation of the office of chief geologist, and its corps was designated the Division of Geologic Correlation. To this division, the work of which is now nearly completed, many minor and temporary investigations are assigned for administrative supervision, and it has thus come to be eminently heterogeneous in its constitution.

Work in Alaska.—As described in previous reports, Mr. I. C. Russell visited the Yukon valley in 1889 as an attache of a party sent out by the U. S. Coast and Geodetic Survey. In the following year he conducted an expedition to the vicinity of Mount St. Elias under the joint auspices of the National Geographic Society and the Geological Survey, and in 1891 he was placed in charge of a second expedition to the St. Elias region under the same joint auspices. In my last report the organization of the second expedition was described and an account was given of its voyage to the field of work and landing at Icy bay no the 6th of June, 1891, at which time communication necessarily ceased until the field work was completed some months later. The purposes of the expedition were, first, to gather information concerning the natural history of the Malaspina glacier, which occupies the coast from Yakutat bay to Icy bay, a distance of 40 miles, and extends to an undetermined distance westward; second, to extend studies begun the previous year on the structure and age of the St. Elias range; third, to determine the height and position of Mount St. Elias; and, fourth, to ascertain the general character of the country immediately north of it. Mr. Russell's equipment included a party of five men, engaged at Seattle, Washington, provisions and camp equipage compactly arranged for transportation over glaciers, surveying instruments, and camera. Crossing the Malaspina glacier and ascending one of its great feeders, the Agassiz glacier, he passed around the eastern flank of the St. Elias mountain and reached a high pass just north of the peak, whence he commanded a view of the northern slope of the range. The ascent of the peak was attempted, but was prevented by storms, and he then returned to the coast, where a base line was measured and the height of Mount St. Elias was determined by angulation. This determination, combined with certain work by the U. S. Coast Survey previously executed at Yakutat bay, affords values of the latitude and longitude of the peak which are more reliable than any previously attained, and which show it to stand very near an important angle in the international boundary, but on the American side. The party then traveled eastward, partly upon the glacier and partly upon the beach, to the head of Yakutat bay, where by previous arrangement a supplementary supply of provisions and a boat had been placed for them by the Rev. Karl J. Hendricksen, who has charge of the mission at Yakutat. With the aid of the boat a long and narrow extension of Yakutat bay, known as Disenchantment bay, was explored to its head, and the party then went to Yakutat, where they arrived late in September, and whence they were conveyed to Sitka by the U. S. steamer *Pinta*. Mr. Russell's report on the Mount St. Elias expedition of 1890 and a special report on the height and position of Mount St. Elias appear in the third volume of the National Geographic Magazine; his general report on the expedition of 1891 is printed by the Geological Survey as one of the accompanying papers of the present volume.

It was announced in my last report that Mr. C. W. Hayes, of the Appalachian Division, was temporarily detailed to accompany as general scientific assistant an expedition by Mr. Frederick Schwatka, which was projected to traverse in the summer of 1891 a region between the Yukon and Copper rivers not previously penetrated by white men. The exploration was successfully accomplished, and among its results were important additions to our knowledge of Alaskan geology, geography and mineral resources. The geographic additions pertain to orography, drainage and vegetation; the geologic, to the northern limit of Pleistocene glaciation, to Pleistocene and recent volcanic activity, to the distribution of the older formations, and to the distribution of gold and copper. An account of these results is printed in Vol. IV of the National Geographic Magazine, occupying pages 117 to 162. The following passage from an administrative report by Mr. Hayes contains a narrative of the expedition and shows the manner in which the journey was accomplished:

> In accordance with your letter of instructions, dated April 2, 1891, and arrangements previously made with Mr. Schwatka, I left Washington April 3. After a few days spent in Boston, Massachusetts, I proceeded to the Pacific coast by way of the Canadian Pacific railway and joined Mr. Schwatka in Victoria, British Columbia, April 26. Nine days were spent at Victoria and Port Townsend completing our outfit, and May 4 we sailed from the latter place on the steamer *City of Topeka*. After a voyage of ten days, by way of Sitka and Glacier bay, we reached Juneau May 14. Mr. Schwatka's original plan was to start into the interior from Pyramid harbor on Lynn canal, going across Chilkoot pass by the regular miners' route to the Yukon basin. On reaching Juneau, however, the citizens offered substantial assistance to the expedition on condition that we should explore the Taku river and ascertain, first, whether it could be navigated by river steamers, and, second, whether

a pack trail could be constructed from the head of navigation on the Taku to navigable waters in the Yukon basin. As this route offered an opportunity for the exploration of a little-known region, it was decided to abandon the original plan and go into the interior by the Taku river and pass.

Ten days were spent in Juneau waiting for the ice to break up in the river and procuring Indians for boatmen and packers. Our party at the start consisted of three white men—Lieut. Schwatka, a miner named Mark Russell, and myself—with seven Indians engaged for the trip up the Taku and across the portage to lake Ahklen. Monday morning, May 25, our party left Juneau in an Indian canoe. Proceeding down Gastineau channel, to the Taku inlet and up the inlet, we reached the broad, shallow mouth of the Taku river toward night. The next morning the actual work of exploration began. The U. S. Coast Survey had furnished us with a chart of Taku inlet, but no attempt had hitherto been made to map the river basin except an extremely rude sketch of the upper portion made by the Western Union Telegraph Company's explorers. Starting from the mouth of the Taku river, I made a continous "track survey" of our route up the river, across the portage to lake Ahklen, down the lake and the Teslin river to the mouth of the latter, where the line connects with the line previously surveyed by Mr. Ogilvie. The methods employed in making this track survey were such as the character of the country traversed and means of travel rendered practicable. The line was platted immediately in the note book, and the topography of the country adjacent to our route was sketched in, the more prominent points being approximately located by a rough triangulation. Direction was obtained by a prismatic compass, and distances by pacing on the portages and by time and eye estimates on the lakes and rivers where our means of transportation was by boat. The line was also checked at several points by sextant observations for latitude.

From the mouth of the Taku river we continued up that stream about 70 miles to the head of canoe navigation. It required seven days to make this distance on account of the high stage of the water and the very swift current. During this time but little opportunity was afforded for making geologic observations, as the boatmen usually kept to the middle of the stream, camping at night on some of the many islands which obstruct the channel.

Leaving the canoe and the main branch of the Taku river at a deserted Indian village, we made a portage of 80 miles, crossing in a northeast direction the high plateau intervening between the coast range and Lake Ahklen. Owing to the small number of packers we had been able to procure, our progress across the portage was slow, so that a fairly satisfactory opportunity was afforded for mapping the country along the route and making geologic observations. We reached the head of Lake Ahklen June 16, and from this point the Indian packers were sent back to the coast. Setting up a couple of canvas canoes, we continued our journey toward the northwest down Lake Ahklen and Teslin river, which forms its outlet. The Lewes was reached June 24, and Selkirk, at the confluence of the Lewes and Pelly, four days later. The original plan had been to continue down the Yukon to the mouth of White river, and up that stream as far as possible by boat, but the Indians whom we found at Selkirk told us the easier route to the head of White river was overland, keeping southeast of the main river valley, and this route we decided to follow.

Great difficulty was experienced in obtaining packers from among the Indians. After a week's fruitless effort the attempt seemed hopeless, and we were preparing to go down to the mouth of White river and try its ascent by boat, when the tide was turned by the opportune arrival of a prospector, Frank Bowker, with two Indians from the Lower Yukon. He had come up the river from Forty-Mile creek, intending to spend the summer prospecting in the White river basin. With his assistance we finally procured five Indians, who promised to go with us to the country of Scolai, beyond the mountains. Dogs were obtained to carry the remainder of the outfit, from which everything not deemed essential to success was discarded.

On July 9, our combined party of four white men, eight Indians, and eleven dogs left Selkirk. Our course lay toward the southwest, through a region never before penetrated by a white man, and known only from the vague reports of the natives. The country between the Yukon and the St. Elias mountain proved to be a high plateau, and though the surface is much broken by deep, narrow valleys, our progress was not so much impeded by vegetation as we had anticipated. Two camps of natives were encountered on branches of White river, and from these we obtained supplies of dried meat which formed an extremely acceptable addition to our somewhat scanty supply of provisions.

After crossing numerous branches of White river, some of which were too deep for fording, upon rafts, and others on the glaciers in which they rise, we reached on July 28 a small stream called the Klet-san-dek, or Copper creek, flowing northward from the St. Elias range. This is where the Yukon Indians have been accustomed to come for supplies of native copper, on which they were formerly dependent for weapons, and which is still used to some extent for making bullets. This was as far as any of the packers had ever been from home, and they knew the country beyond only by report. They refused to go with us farther, assuring us that it was quite impossible to get through the mountains at that time of the year. Bowker had already come farther than he had originally intended, so that he also turned back with the Indians, and our party was again reduced to three. Trusting in our ability to reach an Indian village on Copper river within two weeks, a period for which we had provisions, we decided to push on in that direction. Discarding everything not absolutely essential, our packs still amounted to 75 or 80 pounds apiece, so that progress was necessarily slow. The weather since leaving the coast in May had been very warm, with little rain except local thunder showers, but from this time till we again reached the coast rain was falling most of the time, which added greatly to our discomfort.

Continuing nearly west from the Kletsan, we reached, on the third day after the Indians had left us, a deep pass through the mountain range, and turning toward the southwest across a glacier which fills the bottom of the pass we were in another day on water flowing into the Pacific, one of the head streams of the Chittenah, or eastern branch of Copper river. This stream flows in a deep canyon, whose sides wherever they are not vertical are covered with a dense growth of spruce and alder through which progress was slow and painful. After four days of such traveling we had reached a part of the river where boating appeared not wholly impracticable, and at this point we stopped and built a boat. The materials at our command were scanty, but with willow poles, strings raveled from our pack ropes, and the canvas in which our bedding had been wrapped, we succeeded in fashioning a craft which carried us in safety through almost continuous rapids down the river about 70 miles to its confluence with the Copper river. Here we found the Indian village Taral and the autocrat of the Copper river country, Nicolai, who gave us a hospitable reception and such provisions as he could spare from his scanty stores.

From Selkirk to this point I made a continuous track survey similar to the one already described, except that a larger part of the distance was paced. On the other hand it was necessary to leave the sextant at Selkirk, so that no latitude determinations could be made, but the two ends of the line have been astronomically located, at Selkirk, by Ogilvie and on the Chittenah by Allen, and it is probable that the location of intermediate points is not far out of the way.

We were fortunate in reaching Taral just as Nicolai was preparing for his semi-annual trading trip to the coast. After a wait of four days we embarked in a large skin canoe with Nicolai and a crew of ten natives. The passage down the river was accomplished with comparative comfort, and the fourth day after leaving Taral we were in the broad mud flats of the Copper river delta. Nicolai intended going to Eyak, where two salmon canneries are located on a narrow peninsula between Copper river and Prince William sound. When within a few miles of that place we were met by a native with the report that the Eyak canneries had closed and the traders had left. This report, which we afterwards found to be the invention of a rival trader, turned us back to the head of the delta and down one of the eastern channels fifty miles out of the way, and delayed our arrival at Eyak about four days. From Eyak we were taken to Nutchek by Capt. Humphrey, superintendent of the Pacific Steam Whaling Company's salmon cannery, on the steam tug *Salmo*, but on account of the delay in getting to Eyak we missed the August mail steamer by twelve hours and were obliged to wait a month for the September steamer. We were most hospitably entertained by Capt. Humphrey, so that our detention was rendered far from unpleasant, and opportunity was afforded for making some geological observations about Prince William sound.

Returning to Nutchek September 19, we sailed from that place two days later by the mail steamer *Elsie* and after a somewhat stormy passage reached Sitka four days later. We made close connections there with the steamer *Mexico* for Puget sound, and October 8 landed at Vancouver, British Columbia. I returned at once to the east and reported at Washington, October 21, 1891.

Work in western Tennessee.—For two years Prof. J. M. Safford, of Nashville, Tennessee, has devoted the summer months to a special study of the Wells Creek basin, a district characterized by a peculiar quaquaversal uplift whereby the older formations are brought to the surface at a point remote from all other outcrops. This year a small amount of supplementary field work has been done and a report has been prepared which is now nearly ready for publication.

Work in Connecticut.—For many years Prof. William M. Davis, of Cambridge, Massachusetts, has given attention to the structure of the Newark or so-called Triassic rocks of the southern portion of the Connecticut valley, and an important contribution made by him to the theory of their structure was published by the Geological Survey in the Seventh Annual Report. As soon as the necessary topographic sheets were available it was arranged that the mapping of the Newark areas in Connecticut be executed under Prof. Davis's direction, and the work has now been carried on for two summers with the aid of a number of temporary assistants. The organization of the corps and the progress of the work are set forth in the following extract from a report by Prof. Davis:

The work prosecuted during the last year is based on my personal study of the region in the summer of 1882, when I first learned clearly the character of the problems involved in its structure.

After an intermission of two years, field work was resumed in successive summers, with the assistance of Mr. C. L. Whittle, student in the Lawrence Scientific School of Harvard University. In the absence of topographic maps, attention was then given chiefly to the determination of the extrusive and intrusive origin of the trap sheets which form ridges by which the valley lowland is interrupted, and to the location of various fault lines, by which its monoclinal structure is dislocated. The results thus gained have been reexamined in the Meriden region in minute detail during the successive sessions of the Harvard summer school of geology, which has found this district a most instructive field for study. The close attention thus given by various observers under my direction to one of the most characteristic parts of the Triassic area has been of much importance in securing critical consideration of the more theoretical results of my field work.

In the summer of 1890 the topographic map of Connecticut was sufficiently advanced for use as the basis of areal geological work, to which my chief care has been devoted since then. The New Haven region was mapped by Dr. E. O. Hovey, graduate student of Yale university; the isolated Woodbury-Southbury district was examined and mapped by Mr. H. L. Rich, graduate of Wesleyan university; and the Meriden region by Mr. J. H. Merrill, former student of our summer geological school. During the summer of 1892, areal work was extended over the Hartford and Granby sheets of the state map by Mr. H. B. Kummel, former member of the summer geological school; and the Middletown sheet was placed in charge of Prof. W. N. Rice, of Wesleyan university. The areal work, thus well advanced, will be completed during the present season.

The introduction of paleontological evidence in corroboration of structural indications regarding the succession of the several members of the formation, and of the division of the whole series into blocks by oblique faults, was made in 1890, when I secured the assistance of Mr. S. W. Loper, of Middletown, Connecticut, in the exploration of certain belts of black shales, containing impressions of fish and plants. This work was continued in the summer of 1891, and I believe that we have now examined all the accessible outcrops of these shale belts. As a result, a large collection of fossil fish and plants has been brought together, and while it may not be richer in species than other collections hitherto made, I believe it to have a greater paleontological value, inasmuch as all the specimens that it contains are definitely referred to certain horizons in the formation, instead of being vaguely associated with the formation as a whole. The collection is now deposited in the National Museum, at Washington, awaiting examination by specialists.

The various results thus gained in all the previous seasons of exploration have been charted on a single sheet during the last winter by Mr. L. S. Griswold, graduate student in Harvard college. The general view thus secured is fertile in the production of new suggestions concerning the interpretation of the structure of the formation, leading to the reexamination of certain critical points. Chief among these are the nature of the eastern and western boundaries of the formation, the extension of the oblique fault lines into the crystalline areas east and west, and the special location of certain disputed fault lines at points of peculiar complication. I have placed this task of review in Mr. Griswold's hands, and he has pursued it in the field for several months of the current year. The results that he has gained concerning the eastern boundary of the Triassic formation have been especially novel and interesting.

My own field work for the last year has been limited to the supervision of the assistants above named.

Work in Arkansas.—In cooperation with the state geological survey of Arkansas, a special investigation was made of the Eocene formations of that state for the purpose of correlating them severally with the Eocene formations of the Gulf states. The expense of this work was shared by the state survey and the national Survey, and it was executed by Mr. Gilbert D. Harris, assistant paleontologist, who was detailed by the paleontologic branch for that purpose. The field work, which occupied the months of November and December, 1891, and January, 1892, included supplementary determinations of stratigraphic sequence in Arkansas and the collection of numerous fossils for comparative study. The office work, consisting chiefly of the examination and comparison of fossils, is being carried on as work of the paleontologic branch.

Underground temperatures.—As described in my last report, a well bored near Wheeling, West Virginia, in unsuccessful search for bitumens or brine, was carried to a depth of 4,771 feet, and then placed at the service of the U. S. Geological Survey for the purposes of science. Below the depth of 1,500 feet the well traverses dry rock, in which the distribution of heat is independent of aqueous circulation. All veins of water at higher levels are excluded by an effectual casing, so that the natural distribution of heat in the rock is not disturbed by movements of water in the well, and the most serious difficulties usually encountered in temperature observations are absent. As the well penetrates horizontal strata in a region exempt from orogenic deformation, it may be assumed that the sequence of temperatures in the lower portions of the well is free from dynamic influences and represents purely the phenomena of outward conduction of the nucleal heat of the earth. The well, therefore, affords an unusually favorable opportunity for the determination of subsurface temperatures. In the last fiscal year Mr. William Hallock, detailed for the purpose from the Division of Chemistry and Physics, made a preliminary series of determinations, and had returned to the field with improved apparatus for final work before the beginning of the fiscal year. His observations were completed in July, 1891, and included repeated determinations of temperature at intervals of about 125 feet from top to bottom of well. By reason of the peculiar local conditions and of the skill and care with which the work was executed, it is believed that his results constitute the best series of determinations of underground temperatures yet obtained. But while the work was thus eminently successful, the scientific harvest which the locality seemed to offer was not fully gathered. Had the observations discovered a uniform rate of temperature change at all depths their meaning would be unequivocal, but it was found that the rate of temperature increase itself increased with depth, and the question remained whether this progressive change expresses a general law of subsurface temperatures or is a local phenomenon dependent on inequality in the conductivity of the rocks penetrated. For this and other reasons, it appeared desirable that the well be deepened and the series of observations on temperatures and associated rocks carried farther. In the original boring of the well, by the Wheeling Development Company, the economic quest was abandoned at a depth of 4,100 feet, but the work was continued to a further depth of 370 feet in the interest of scientific investigation. It was then stopped because the machinery employed was not adapted to deeper work, but so great an interest had been developed in the scientific results which might accrue that public-spirited citizens of Wheeling agreed to incur the expense of carrying the bore to a depth of 6,000 feet if the necessary apparatus could be otherwise furnished. Unfortunately all attempts to secure the funds necessary to reequip the well have thus far proved unsuccessful. A second deep well at Radford, West Virginia, penetrating an entirely different series of strata and reported to be practically dry, was kindly placed by its owners at the service of the Geological Survey, and an attempt was made to repeat there the series of temperature determinations obtained at Wheeling. But unfortunately the measures taken to prevent the access of water to the well were inadequate, and its condition did not permit satisfactory work. A preliminary statement of the results obtained at Wheeling was published in the American Journal of Science for March, 1892, and a full report is in preparation.

Geologic correlation.—The Division of Geologic Correlation was temporarily constituted of a number of paleontologists and geologists of the Survey for the purpose of assembling the published and unpublished data for the correlation of American formations one with another and with standard formations of other countries, and for the further purpose of discussing from the American standpoint the principles of geologic correlation. In addition to this literary work, and for the purpose of rendering it more effective, most of the collaborators visited typical localities with which they were personally unacquainted. The field work, the labor of compilation, and the preparation of reports were chiefly accomplished in preceding years, and the present year has been devoted mainly to publication. The reports constitute a portion of the series of bulletins of the U. S. Geological Survey, and are numbered in consecutive order, beginning with 80. The following have appeared during the year:

Bulletin No. 80. Correlation Papers, Devonian and Carboniferous, by Henry Shaler Williams, pp. 279.

Bulletin No. 81. Correlation Papers, Cambrian, by Charles Doolittle Walcott, pp. 447.

Bulletin No. 82. Correlation Papers, Cretaceous, by Charles A. White, pp. 273.

Bulletin No. 83. Correlation Papers, Eocene, by William Bullock Clark, pp. 173.

The following are in press:

Bulletin No. 84. Correlation Papers, Neocene, by William Healey Dall and Gilbert Dennison Harris.

Bulletin No. 85. Correlation Papers, Newark System, by Israel Cook Russell.

Bulletin No. 86, Correlation Papers, Archean and Algonkian, by Charles Richard Van Hise.

Bulletin No. 88, on the Pleistocene, is to be written by Prof. T. C. Chamberlin, but he has been unable as yet to find the time necessary for its preparation. Bulletin No. 89 will contain an annotated catalogue of American formation names by Mr. W. J. McGee. Its preparation, which was begun before the constitution of the Division of Geologic Correlation, has been somewhat advanced during the fiscal year, and, now that the data assembled by the other essayists is fully available, will be rapidly pushed to completion. The series of essays thus completed or in preparation covers the entire range of American formations, excepting those of the Jura-Trias and of the Silurian. In the original plan the Jura-Trias was assigned to Mr. Russell, but it was afterwards decided to take advantage of exceptional opportunities for geologic exploration in Alaska and detail him to that work. The scope of his research was for that reason restricted to the Newark formation, the sole eastern representative of the Jura-Trias. The Jura-Trias of the West exhibits greater variety of sedimentation and has been observed through a vast range of country, but it has yielded so few collections of fossils that the data for correlation are meager, and partly for this reason the work of the division will be closed without undertaking its discussion. The Silurian was assigned, together with the Cambrian, to Mr. Walcott, and the collation of data was begun by him, but the double field was found so large that it seemed advantageous to restrict his attention for the time being to the Cambrian. When this decision was reached it was impracticable to assign the Silurian to another, and its consideration was set aside with the understanding that it would constitute a future study by Mr. Walcott in connection with the regular work of his division.

Duties connected with the general work of the branch have left me little time for personal work in the field, but two brief excursions were made. A short time was spent in July in the continuance of a study in the Finger lake district of western New York of preglacial or interglacial drainage in relation to the sculpture of the land by the great ice sheet. Later in the season an examination was made in Arizona of a peculiar crater which had attracted attention by reason of the discovery in its immediate vicinity of numerous masses of meteoric iron. As the crater is not constituted of volcanic rock it was thought that its origin might be independent of volcanic action, and it seemed possible that it had been caused by the impact of a large mass of meteoric iron of which the discovered bodies were fragments. In such case the mass producing the crater would lie in the earth at some point beneath the cavity, and its presence should be detectable by means of local magnetic phenomena. In order to test the matter I secured the cooperation of Mr. Marcus Baker, general assistant of the Survey, who had previously conducted magnetic observations of precision. In his company and with the necessary apparatus I proceeded to Flagstaff, Arizona, where a camping outfit was secured, and thence to the crater, which is locally known as Coon butte. Two weeks were occupied in the topographic, geologic and magnetic survey of the butte and vicinity, and a similar period was afterwards spent in comparative studies among the basaltic craters covering the plateau about San Francisco mountain. Certain rocks and meteoric specimens collected in connection with the field investigation were studied in the petrographic laboratory by Mr. Diller and in the laboratory of the Chemical Division by Mr. Melville. Other office work was performed in the same connection, but time has not yet been found for the preparation of a final report on the observations.

Herewith are submitted also the administrative reports of the several chiefs of the geologic divisions.

Very respectfully, your obedient servant,

G. K. Gilbert,
Chief Geologist.

Hon. J. W. Powell,
Director U. S. Geological Survey.

REPORT OF PROF. N. S. SHALER.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
ATLANTIC COAST DIVISION,
Cambridge, Mass., June 30, 1892.

SIR: I have the honor to submit the following report concerning the work done in the division under my charge during the year ending June 30, 1892. The greater part of the work undertaken has been in connection with the surface geology of New England. The field work of twelve sheets of this survey has been completed. Of these, five are in Connecticut, two in Rhode Island, and five in Maine. The sheets previously done in Massachusetts have been in good part revised and adjusted, and the accompanying descriptions made ready for publication. The lenticular hills or drumlins which occur in Massachusetts have been delineated in the greater part of the district east of the Connecticut river. In this work I have been assisted by Messrs. R. E. Dodge, L. H. Davis, C. R. Eastman, E. T. Brewster, J. H. Ropes, and G. H. Barton. The last named gentleman has had sole charge of the work upon the drumlins. Messrs. J. E. Spurr and R. Macallister served as field assistants.

The field work, other than that of a revisionary nature, was as far as possible done with the photographs of the plain table sheets of the topographical survey in hand. An effort has been made to correct any errors which might appear in these sheets and to transmit the revised maps to the Washington office in time for them to be used before the plates are engraved. Experience has shown that no additional time is necessary for this critical work.

Work on the bed rocks of the Narragansett basin has been under the immediate charge of Mr. J. B. Woodworth. He has received some assistance from Mr. J. R. Finlay and Mr. H. Landes During the year the task of interpreting the succession of the rocks in this field has been continued by Mr. Woodworth, and the results appear to indicate that the succession of the strata is now determined. The relations of the granitic rocks which border the basin and lie within it, to the stratified deposits have been determined. The areal work has been done on about one-half of the basin. During the winter Mr. Woodworth has been engaged in petrographic studies on the stratified and intrusive rocks of the western side of the basin, the object being to determine the points necessary for the stratigraphic work. Mr. G. L. Collie, acting as volunteer assistant, has prepared an elaborate memoir on a difficult part of this field contained within the limits of Connanicut island. This work will be embodied in the forthcoming report.

Mr. Woodworth has also done some work of an incidental nature in Cambridge and the neighboring towns. This has resulted in the discovery of a small but distinct fauna in the argillaceous rocks of this vicinity which have hitherto yielded no fossils though they have long been the subject of study.

A paper for this annual report, entitled the Geological History of Natural Harbors, has been transmitted to your office. A paper on the agricultural uses of New England fresh-water swamps and marine marshes has been published by the Massachusetts State Board of Agriculture. A memoir on the Boulder Train from Iron Hill, Cumberland, Rhode Island, has been communicated to the memoirs of the Museum of Comparative Zoology, at Cambridge, Massachusetts. The above named papers are by myself. Mr. Woodworth has published a paper embodying work of the survey in the American Geologist entitled "On the Occurrence of Erratic Cambrian Fossils in the Neocene Gravels of the Island of Marthas Vineyard."

During the winter of the present fiscal year I made a journey southward along the coast line to central Florida in order to obtain data which have been embodied in the above mentioned report on harbors. In the course of this journey I made some studies upon the pebble phosphates of the district west and south of Tampa the results of which were communicated to Mr. Geo. H. Eldridge, geologist of the survey in charge of that field.

Very respectfully, your obedient servent,

N. S. SHALER,
Geologist in Charge.

Mr. G. K. GILBERT,
Chief Geologist.

REPORTS OF MR. RAPHAEL PUMPELLY.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
DIVISION OF ARCHEAN GEOLOGY,
Dublin, N. H., June 30, 1892.

SIR: I have the honor to submit the following administrative report as to the work of the Archean Division during the year ending June 30, 1892:

The field work was distributed through central and western Massachusetts, northern Connecticut, eastern New York, and central Vermont. Prof. Emerson was employed in working out the structure and in mapping the areas of crystalline rocks, covered by the Sandisfield and Granville (Massachusetts) sheets, and by the Granby and Tolland sheets in Connecticut. His temporary assistants were Mr. Joseph H. Perry, Mr. William Orr, and Mr. Fred A. Peck. Mr. Perry was employed in mapping the geology of the Blackstone and Franklin sheets, and Mr. Orr in tracing and mapping the limestone bands in the Hawley, Greenfield, and Northampton areas, and Mr. Peck in mapping the geology of the Granville (Massachusetts) and Granby (Connecticut) sheets. During the winter Prof. Emerson was employed in office work upon the geology of the following sheets in Massachusetts: Beckit, Hawley, Chesterfield, Granville, Greenfield, Northampton, Springfield, Warwick, Belchertown, and Palmer.

Mr. Dale completed the study of the structural geology of the area covered by the Berlin sheet (New York) and also finished the geological map and cross sections of that sheet. He then undertook the study of the structural geology of the valley of Vermont, south of Rutland, which he continued successfully as far as seemed to be proper in the absence of topographic maps. During the winter, Mr. Dale was occupied in the office in drawing the maps and cross sections of the Berlin sheet, and of the area studied by him in Vermont. Mr. Whittle, temporarily assisted by Mr. Vea, was employed in continuing the study of the structure of the central range of the Green mountains in central Vermont, and in tracing the boundaries and varying phases of the crystalline rocks across this axis. Through the winter Mr. Whittle was occupied in petrographic work upon the material collected in Vermont. Mr. William H. Hobbs was employed during July, August, and September, on the areal and structural geology of the southern half of the Sheffield sheet in southwestern Massachusetts, including Mount Washington. Mr. Aug. F. Foerste was employed during part of the season with Mr. Dale in central Vermont.

Besides my administrative work, I have devoted much of my time to a general study of the metamorphic areas of the country to aid me in interpreting and correlating the results obtained in the different parts of the field assigned to me.

The classification of the pre-Cambrian rocks of North America rests largely upon the studies of the earlier Canadian geologists in Canada. Partly on this account, and partly because the Canadian areas are continuous into the United States, I made, in company with Prof. Van Hise, several extended excursions, at my own expense, through the typical areas of Canada. We studied Logan and Murray's original Huronian localities north of Lake Huron, and those of the so-called Laurentian limestones in Quebec. From these excursions I obtained information which will have much value in interperting the Green mountain geology.

The object I have kept in view has been the production of a geological map of western New England. The rocks of this region are highly metamorphosed and change from one area to another in character and appearance. The structural geology is very complicated and fossils are exceedingly difficult to find. In order to get a basis for correlating these rocks among themselves, and determining their position in the geological scale, it was necessary to work out the structure of the Green mountains which stand between the fossiliferous rocks of New York and the crystalline schists of New England. For this special structural study two broad belts were selected, one extending from the Connecticut river across Hoosac mountain, in Massachusetts, to the Hudson river; the other from the Connecticut river across central Vermont to the crystalline rocks of Lake Champlain. The results obtained from this structural work are highly satisfactory, and have shown that it is possible both to correlate the crystalline schists within their own areas and to determine their ages. Were this not so it would not be possible to make a geological map of New England that would show other than lithological distinctions.

From the results obtained already we have been able to color the atlas sheets of Massachusetts and to begin upon those of Connecticut.

The following papers, based chiefly on the work of the division, have been published by its members during the year:

Observations upon the structural relations of the Upper Huronian, Lower Huronian, and Basal Complex on the north shore of Lake Huron, by Raphael Pumpelly and C. R. Van Hise. Am. Jour. Sci., 3d ser., vol. XLIII, pp. 224-232, March, 1892.

The Greylock Synclinorium, by T. Nelson Dale. American Geologist, vol. VIII, pp. 1-7, July, 1891.

Plicated cleavage-foliation, by T. Nelson Dale. Am. Jour. Sci., 3d ser., vol. XLIII, pp. 317-319, April, 1892.

Proofs that the Holyoke and Deerfield trap sheets are contemporaneous flows and not later intrusions, by B. K. Emerson. Am. Jour. Sci., 3d ser., vol. XLIII, pp. 146-148, February, 1892.

A paper on "The Rensselaer Grit Plateau," by T. Nelson Dale, appears in the present volume. A memoir on the "Geology of the Green Mountains in Massachusetts," by Raphael Pumpelly, J. E. Wolff, and T. Nelson Dale, is in the hands of the Public Printer, and will constitute Monograph XXII of the Survey. A paper has also been prepared by Mr. Dale on "The Structure of the Ridge between the Green Mountains and the Taconic Range in Vermont," and will soon be offered for publication as a bulletin of the Survey. The material is all collected for the geology of western and central Massachusetts, including Worcester county, and rough drafts have been made of the corresponding atlas sheets. They need now only the revision made necessary by the general progress of the work.

I have the honor to be, sir, your obedient servant,

RAPHAEL PUMPELLY,
Geologist in Charge.

Mr. G. K. GILBERT,
Chief Geologist.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
NEW JERSEY DIVISION,
Dublin, N. H., June 30, 1892.

SIR: I have the honor to submit the following report for the New Jersey Division for the year ending June 30, 1892:

The work was intrusted to the immediate care of Mr. J. E. Wolff, with Mr. R. S. Tarr as assistant. Mr. L. G. Westgage was employed during the field season and part of the winter, and Dr. Aug. F. Foerste for a month in the autumn, and Mr. Harry Landes during June, 1892.

In the beginning of the year Dr. Wolff made a reconnoissance of the highlands of New Jersey and New York, and devoted the rest of the season to the detailed geological mapping of the area between Hibernia and Denmark, in Morris county, and extended this work during the spring of 1892 to Dover.

Mr. R. S. Tarr has done a considerable area of the map from the western border of the highlands at Andover, New Jersey, eastward to Lake Hopatcong, in Sussex and Morris counties. Mr. Westgage was employed during the season of 1892 on areal work in the northern end and slopes of Jenny Jump mountain, in Warren county, in the southern part of the state, and during June of the present year, began areal work at Midvale, on the northeast edge of the highlands. Dr. Foerste examined the sandstones and limestones along part of the western edge of the highlands for fossils, and some of the narrow bands of stratified rocks within the belt. He aided the general work by finding about six new localities of fossils.

The office work consisted in the working up and plotting of the field notes and study of the specimens. About 800 thin sections were studied under the microscope and the results used in coordinating the field observations.

Substantial progress was made in the beginning of the areal geology and in becoming acquainted with the problems in this difficult region of crystalline rocks.

During the year Mr. Tarr has published a paper based upon observations made during his connection with the Atlantic Coast Division. It is entitled "The Central Massachusetts Moraine," and appeared in the American Journal of Science, 3d ser., vol. XLIII, pp. 141-145, February, 1892.

I have the honor to be, sir, your obedient servant,

RAPHAEL PUMPELLY,
Geologist in Charge.

Mr. G. K. GILBERT,
Chief Geologist.

REPORT OF MR. W. J. McGEE.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
POTOMAC DIVISION,
Washington, D. C., June 30, 1892.

SIR: I have the honor to submit the following report of operations in the Potomac division during the fiscal year closing to-day:

PLAN OF WORK.

The field of the division, originally the District of Columbia and contiguous territory, and later the coastal plain in the middle Atlantic slope, has been gradually extended over the entire coastal plain province of southeastern United States, i. e., the low-lying zone of little disturbed clastic deposits extending from Sandy Hook to the Rio Grande, with a width ranging from 10 to 300 miles. The zone is a geologic unit. Throughout it the formations are so closely related in character and genesis as to demand general reconnoissance as a basis for local study. Certain conditions require the extension of research into correlative areas of degradation (i. e., the Piedmont and Appalachian zones), and moreover the operations of other divisions are extended into the coastal zone, notably in Florida and among the tidal marshes; and accordingly the definition of the field work is less trenchant than that of the natural province.

Early studies by states and private individuals give general information concerning the structure and other characteristics of the province, and this information has been supplemented by reconnoissance of the entire province and detailed studies along certain lines; and a general plan of work has been framed to fit the natural conditions and meet the industrial needs of the province. This plan has been set forth in some detail elsewhere,[1] but requires summary statement as a basis for the report of operations carried forward in accordance with it.

The coastal plain is built up of a series of unconsolidated deposits of sand, clay, silt, glauconite, loam, gravel, etc., either separate or combined in various proportions. The contiguous formations are parted sometimes by transitional beds, more frequently by uncomformities representing ancient land surfaces with attendant soil and surface erosion. Some of the formations are characterized by distinctive assemblages of the fossil remains of ancient life; and, most important of all, each formation is characterized by fairly constant features of composition and structure which affect the fertility and other properties of soils derived therefrom, and which fix the value of the deposit as a source of natural fertilizers, brick and pottery clays, molding and building sands, ochres, iron ores, lignites, infusorial powders, gravel for road material, or other resources. Now each formation is fairly uniform in composition and structure, and so in actual industrial value throughout its area, and in this way the formation, defined by physical characters, becomes the most useful unit of classification; it is indeed the industrial unit. Moreover, each formation, whether of coarse material or fine, of chemic precipitates or mechanical sediments, or of diverse materials, represents the product of certain processes or agencies, which may commonly be inferred, and so it becomes a definite genetic unity which must be set apart as a basis for geologic history. Furthermore, each formation and each unconformity between formations is a record of relative position of sea and land, and thus the formation becomes a unit of geographic development or continental evolution. Finally, the recognition of the mode of genesis of each formation, and of the geographic condition which it represents, gives a means of correlating exposures at widely separated points more trustworthy for this province at least than any other ever devised, and in this way renders the succession of coastal plain deposits an easily read record of the evolution of a tenth part of the continent, a fifth of the country. So an essential feature of the plan of work consists in a classification adapted at once to industrial needs and scientific ends.

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[1] The Lafayette Formation, 12th Ann. Rept. U. S. Geol. Survey, 1892, p. 380 et seq.

The methods of work in the division are determined chiefly by the fundamental plan; subordinately by a variety of conditions. A general reconnoissance has been carried over the province, and a number of sections through it have been worked out with the view of ascertaining the extent and relations of the different formations. Later certain formations were taken up for moderately detailed study and monographic description, and in the portions of the province covered by topographic surveys the areal distribution of the different formations has been or is being worked out in detail. Thus far it is possible to map the wide-stretching formations of the province (at least two of which extend from the Raritan to the Rio Grande) only in general and preliminary terms, and final monographs can be prepared only after the detailed studies and local maps are completed; but since it is found that monographic description is of great and nearly indispensable use in mapping, the two lines of work are carried forward together as nearly as may be. Expediency, however, demands the advancement sometimes of one line, sometimes of the other; thus the Lafayette formation has been monographed in general terms for the entire coastal plain, while in the middle Atlantic slope mapping is extended to formations of unknown extent and uncertain genesis.

PERSONAL WORK.

The months of July and August were spent chiefly in the office in routine administrative work and in revising proofs of lithographs. Some field work was performed during both months in reviewing Mr. Darton's areal studies in the District of Columbia, Maryland, and Virginia, and during August in examining, in company with Prof. Salisbury, the northern extension of the Columbia formation and its transition into premorainal drift.

On September 5 I was joined at Grand Junction, Tennessee, by Dr. E. W. Hilgard, Dr. E. A. Smith, and Prof. J. A. Holmes, of this division, Mr, Lester F. Ward, of the paleontologic branch, and Mr. R. T. Hill, temporarily connected with that branch, and Prof. James M. Safford, state geologist of Tennessee; and with this party proceeded to review the field work of the preceding season on the Columbia, Lafayette, and associated formations in western Tennessee, Mississippi and

Louisiana. Special studies were made at Grand Junction, Memphis, Ripley, Curve, and Randolph, Tennessee; Holly Springs, Oxford, Natchez, Ellis Cliffs, and Fort Adams, Mississippi; and Bayou Sara and Port Hudson, Louisiana. Messrs. Ward and Hill made small but representative collections of fossil plants at various localities; Dr. Hilgard made a considerable collection of materials representing the Neocene and Pleistocene deposits of the region for chemic and microscopic examination; while Dr. Smith and Prof. Holmes extended their acquaintance with the somewhat variant, yet surprisingly consistent, characters of formations already under study in a different part of the province; and the joint work did much to harmonize views concerning the origin, relations, and characteristics of the Columbia and Lafayette formations. The study of these formations is of special importance in this region, particularly in upland Mississippi, where sometimes one, sometimes the other, constitutes the land surface; the soils derived from them are of unequal value, and each is adapted to distinct crops and special modes of tillage; and they are differently affected by old-field erosion, which has already wrought lamentable destruction in different portions of the coastal plain, and is progressing with ever-increasing rapidity. There is no portion of the province in which research concerning the character and distribution and the industrial excellencies and defects of the formations is more urgently demanded.

Prof. Safford proceeded only as far as Oxford, Mississippi, and the party divided at New Orleans; Prof. Holmes repairing with Dr. Smith to Tuscaloosa, Alabama, where he extended his comparative studies; Dr. Hilgard returning to his laboratory at Berkeley, California, to begin examination of his materials; and Mr. Ward, Mr. Hill, and myself proceeding to Texas for the purpose of extending the reconnoissance of the coastal plain to the international boundary. Special studies were made at San Antonio, Laredo, Corpus Christi, Austin, Belton, Dallas, and Texarkana; and on the return trip the study was extended into southwestern Arkansas, notably at Nashville, Center Point, and Arkadelphia. Throughout great assistance was rendered by Mr. Hill, and much information was gained through Prof. Ward's familiarity with the fossil plants found in certain formations. Both the Columbia and Lafayette formations were traced to the Rio Grande, and data relating to their physical and other characters and to the local features of distribution were collected. Important data relating to several other formations, notably the Trinity (the southwestern equivalent of the Potomac formation), were also obtained. About the middle of October I returned to Washington, leaving Messrs. Ward and Hill in the field.

The period from the middle of October to the middle of December was spent chiefly in the office in digesting the data collected in the field and in routine administrative work, as well as in revising proofs of text, cuts, and plates for the twelfth annual report; also in revising from time to time proofs of lithographs for the Eleventh Annual Report. Some time, however, was spent in the field, chiefly in the vicinity of Washington, reviewing Mr. Darton's excellent areal work.

About the middle of December I repaired to Columbus, Georgia, to join Profs. Chamberlain and Salisbury in a study of typical coastal plain localities. With these gentlemen I proceeded thence to Montgomery and Tuscaloosa, Alabama, and to Meridian, Natchez, and other points in Mississippi, leaving them at Natchez near the end of the month to extend their journey into Louisiana, while I returned to Washington. This journey resulted in detailed notes, sketches and photographs, and in general additions to knowledge concerning a specially significant portion of the province.

The first quarter of the calendar year was spent chiefly in the office in revising proofs of a paper in the Twelfth Annual Report and lithographs for both the eleventh and the twelfth, in indexing the papers in the latter, and in continuing the collection of material for the Thesaurus of American formations and the revised edition of the geologic map of the United States; and during this period, as well as during April, occasional trips were made in the field, chiefly in portions of Maryland and Virginia contiguous to the District of Columbia. A considerable part of May and part of June were devoted to completing and placing in the hands of the engravers the base for a geologic map of New York and in gathering additional data for the geologic impression. This work involved journeys to New York city and Albany. Meantime work on the Thesaurus and the revised geologic map of the United States was carried forward and a number of field journeys were made chiefly for the purpose of reviewing previous work.

WORK OF MR. N. H. DARTON.

Areal surveys.—Seven months were devoted to field work in continuing the delineation of the areal distribution of the Cenozoic and Mesozoic formations of eastern Virginia and Maryland. Detailed studies in this portion of the coastal plain have now been carried over the entire area, mapped topographically, and been provisionally extended beyond the limits of the topographic maps in eastern Virginia. In addition, reconnoissance work has been extended over the greater part of Delaware and the "Eastern Shore" of Maryland. The work has resulted in the preparation of the following geologically colored atlas sheets: The Washington (double) sheet and the Baltimore sheet, engraved and printed in small preliminary editions (both prepared in conjunction with Dr. George H. Williams, by whom crystalline terranes were delineated); and the following sheets colored and many of them reviewed ready for engraving:

Sheets.	Scale.	Remarks.
Fredericksburg	1 : 125,000	Including a small area of crystalline rocks.
Montross	1 : 62,500	
Piney point	1 : 62,500	
Point Lookout	1 : 62,500	
Wicomico	1 : 62,500	
Leonardtown	1 : 62,500	
Brandywine	1 : 62,500	
Prince Frederick	1 : 62,500	
Owensville	1 : 62,500	
Bloodgoods	1 : 62,500	
Sharps Island	1 : 62,500	
Drum point	1 : 62,500	
Annapolis	1 : 62,500	
North point	1 : 62,500	
Relay	1 : 62,500	Crystalline terranes delineated by Dr. Williams.

Field work is practically completed also in the areas covered by the Mount Vernon, Laurel, and Gunpowder sheets, but these are awaiting review and the completion of Dr. Williams's work on the crystallines. The total area mapped during the year and either engraved or ready for engraving is approximately 6,000 square miles.

In addition detailed surveys have been practically completed over an area of 6,000 square miles chiefly beyond the limits of the topographic surveys in eastern Virginia, though a small amount of field and office work will be required before engraving.

The distribution of these areal surveys is shown graphically in the accompanying Pl. II.

The areal surveys of the year have yielded important data relating to the distribution and character of the several structural units developed in this portion of the coastal plain, and have resulted incidentally in better definition of several of these formations; accordingly the value of the results is not to be measured simply by the area covered—this is a key area, selected largely because of its representative character, and the structural and other relations determined within it give a basis for extending operations both northward and southward.

Collateral researches.—During the entire period of field work much attention was given to the collection of data relating to the economic resources of the region; the distribution of the glauconitic sands (or greensand marls) was studied, and samples were taken from various points with a view to determine their absolute and relative value as fertilizers; the brick and pottery clays were examined as to character and distribution; fuller's earths, ochers, iron ores, glass sands, polishing materials (infusorial earths), building stones, etc., were examined, and their economic value and availability were carefully studied with a view to early publication. The mineral glauconite (the silicate of potash and iron constituting the fertilizing elements of the greensands) was a subject of special investigation. This material is an important constituent of several formations of the coastal plain and is known in many other countries; yet its origin and laws of distribution are unknown. Extensive collections of the material were made in New Jersey, Maryland, and Virginia, and a part of these have been studied microscopically and chemically. This investigation is far from complete, yet promises to throw light on the important economic and scientific questions involved in this obscure deposit.

Fossil discoveries.—Certain of the coastal plain formations, notably the Columbia and Lafayette, are of littoral character, and hence are practically unfossiliferous. The interest and importance of fossils vary inversely with abundance, and the finding of fossils in these practically barren formations has long been earnestly desired. One of the results of the year's work was the discovery of fossils in the Lafayette formation near Heathsville, Northumberland county, Virginia.

The prevailing crystalline rocks of the Piedmont Zone have suffered alteration to such extent that they are even poorer in traces of past life than desposits of the coastal plain. It is accordingly of special interest to note the finding of highly organized fossils at Arvon, Buckingham county, Virginia, during the present season, in roofing-slates hitherto commonly referred to the Archean.

Office work.—Some four months were spent in the office, chiefly in bibliographic work. The Record of North American Geology for 1891, which is now in press, was prepared, and the proofs of the preceding record were revised. In addition, work has been continued on an Author's Catalogue of Papers Relating to North American Geology (1790 to 1892), commenced some years since, and now nearly completed. The Stanton atlas sheet, geologically colored during previous years, was revised, and the explanatory text thereof was written. In addition the various notes relating to the scientific and economic aspects of the coastal plain were digested and systematized for future use.

Work in New York.—The entire month of June was occupied in a detailed reconnoissance of an area of 1,000 square miles, centering about Oneonta, New York, made for the purpose of delineating the formations on the forthcoming geologic map of that state. The preliminary copy of the map was incomplete in several areas, one of the largest of which was that about Oneonta, a puzzling region in which the distinctive sandstones and shales of the Catskill formation grade by transition and interleaving into the Chemung and Portage rocks of central New York. The reconnoissance was eminently successful, and resulted in determining the terranes of the several formations in such manner as to permit the extension of geologic colors over the entire area.

WORK OF PROF. JOSEPH A. HOLMES.

Prof. Holmes continued his examinations of the coastal plain formations at intervals throughout the year. Early in the year he participated in the joint reconnoissance in Tennessee, Mississippi, and Louisiana, and afterward extended his studies through Alabama and Georgia. Subsequently a series of overland journeys were made along the western or landward border of the coastal plain in North Carolina and South Carolina, and a series of cross-section journeys were made along the several lines of railway extending from this inland border to the coast in both States; and in addition special examinations were carried across the coastal zone along the Roanoke, Tar, and Cape Fear rivers.

The formations encountered in these journeys were the Columbia, the Lafayette, several earlier Neocene, Eocene, and later Cretaceous formations, and the earlier Cretaceous Potomac formation. These were studied as to their composition and characters, in their relations to each other, and especially as to the physiographic conditions under which the deposition of each took place, as well as the physiographic conditions which existed during the several erosion intervals. With reference to the latter problems but little has thus far been discovered that is new in relation to the older formations; but the later formations, chiefly the Columbia and the Lafayette, have yielded more satisfactory results. One of the most serious difficulties encountered in this region is the separation of the last-named formations at such levels as might be possible for both; but the results of recent studies on the Roanoke, both above and below Weldon, where this difficulty was especially marked, were eminently satisfactory, and gave criteria useful for the discrimination not only on that river but in other portions of the Carolinas.

Progress has been made in the preparation of a memoir on the characters and distribution of the Columbia, Lafayette, and associated formations—the soil-makers of most of the coastal plain—in eastern North Carolina.

WORK OF DR. EUGENE A. SMITH.

After participating in the joint examination of the Columbia and Lafayette formations in the Mississippi embayment in September, Dr. Smith proceeded to Tuscaloosa, and from that point as a center extended observations upon these and associated formations along different lines in the lowland portion of the State, and acquired data for mapping considerable areas. During one trip he traversed the western part of the Chattahoochee basin from Columbus to some distance below Eufaula, collecting valuable information concerning the areal distribution, structural characters, and agricultural capabilities of the deposits. Previously it was ascertained that the lower portion at least of the Lafayette formation is phosphate-bearing in western Florida, and Dr. Smith ascertained that it contains an element of phosphate of lime in southeastern Alabama, but thus far this fertilizing material has not been found in sufficient quantity for extraction, though it increases the agricultural value of the soils yielded by the formation in certain localities.

A considerable part of the winter was spent in office and laboratory work upon the data collected in the field, and a memoir embodying the results of the work is approaching completion. When President Chamberlin, Prof. Salisbury and I traversed central Alabama in December, Dr. Smith joined us at Cottondale and piloted us to several typical localities. During the spring fieldwork was resumed, and some time was spent with Mr. Lester F. Ward in detailed study of the Tuscaloosa and associated formations, at several points in central Alabama, for the purpose of collecting plant remains, and more clearly discriminating this formation on the contiguous Eutaw formation as well as the later deposits made up in part of Tuscaloosa materials.

WORK OF DR. WILLIAM B. CLARK.

With the beginning of the fiscal year a small allotment was made to Dr. William B. Clark for the purpose of commencing areal work in peninsular New Jersey; in September, 1891, he began field operations. The autumn was spent in a reconnoissance extending over a considerable part of the peninsula, made for the purpose of discriminating the structural units of the area and developing a classification thereof in accordance with the plan already stated. In the course of the reconnoissance a series of sections was made at critical points, in order to establish the sequence of the formations represented. This preliminary work resulted in a tentative classification, which was adopted as a basis for detailed work, in which it has thus far been found satisfactory. By reason of exceptionably favorable weather field work remained practicable nearly to the close of December, by which date Dr. Clark had acquired a good general knowledge of the geology of the region.

In May detailed work was commenced on the New Brunswick and Sandy Hook atlas sheets, and the area covered by them was surveyed with care. Subsequently the surveys were carried into contiguous areas. The formations of the Sandy Hook and Long Branch atlas sheets have already been mapped. The New Brunswick sheet is practically completed and considerable portions of Asbury Park and Cassville sheets are colored. Three sheets are therefore in condition for final review and publication.

Dr. Clark's work was facilitated and greatly extended by the cooperation of the State through Dr. John C. Smock, state geologist of New Jersey.

WORK OF DR. EUGENE W. HILGARD.

Several of the formations found in that portion of the coastal plain lying within the Mississippi embayment are poor in fossils and without distinctive structural features, so that their discrimination is difficult and sometimes uncertain. With the view of establishing additional criteria for discrimination, it was deemed necessary to make microscopic and chemic examinations of the materials of some of these formations; and by reason of his extended familiarity with both microscopic and chemic work and his long acquaintance with the deposits of the Mississippi embayment, Dr. Eugene W. Hilgard, of the University of California, was selected for the investigation. Early in the fiscal year he proceeded to the field; in September he joined in the field review already noted and made extensive collections at various localities in Mississippi, Tennessee and Louisiana, and these collections were afterward supplemented by materials collected from other portions of the coastal plain and forwarded to him by Dr. Smith, Prof. Holmes and Mr. Hill.

After completing the field work Prof. Hilgard repaired to Berkeley, California, and began the study of the collections. Considerable progress was made, but by reason of his ill health the work has not yet been completed.

WORK OF DR. GEORGE H. WILLIAMS.

By reason of administrative convenience as well as by reason of the intimate relation between the contiguous geologic provinces, an investigation of the Piedmont crystallines by Dr. George H. Williams has been carried forward in this division. During the past year eminently satisfactory progress has been made in this investigation, upon which Dr. Williams reports as follows:

Field work.—The field work has been pursued with two distinct objects, viz: areal mapping of atlas sheets and the study of definite geological or petrographical problems.

In an area of such extreme complexity, where the rocks are greatly decayed and the exposures poor and widely separated, the areal mapping on the scale of one mile to the inch necessarily is slow and laborious. Its success is to a considerable degree dependent on the previous solution of certain general problems involving the nature and relationships of the rocks to be mapped. Within the last year the Baltimore sheet has been completed and printed; the Relay sheet also is finished, and the Ellicott sheet is almost completed, while considerable progress has been made on the Laurel, Gunpowder, and Frederick sheets. Some areal mapping has also been done outside of the areas thus far topographically surveyed, notably in the vicinity of Whitehall, Baltimore county, Maryland. In this work I have had the volunteer assistance of Messrs. F. P. King and M. J. Vea.

The special geological and petrographical problems investigated include the structure of Sugarloaf Mountain in Frederick county, Maryland, during last July and August; the course of alteration of our peridotites and pyroxenites to serpentine and steatite; the origin and comparative mineralogical composition of our pegmatite veins and dikes; the field evidence of the eruptive character of our granites; and a preliminary examination of an extensive series of acid and basic volcanic rocks with accompanying ashes, recently discovered in the Blue ridge. In the last-named investigation I have been materially assisted by Miss Florence Bascom and Mr. S. L. Powell.

Office and laboratory work.—Office and laboratory work has included the preparation of scientific papers and reports, the coloring of geologic maps for publication, and the petrographical investigation of crystalline rocks collected in the field with the microscope and other instruments. During last August an account of the geologic structure of the Piedmont plateau in Maryland was prepared for the guide books offered to the International Congress of Geologists, and in February a more extended account of the geology around Baltimore was published for the use of the American Institute of Mining Engineers. The latter was accompanied by the atlas sheet "Baltimore," geologically colored in accordance with the scheme adopted by the Survey; the first complex area of crystalline rocks represented in this way.

Besides this map, which was issued by the Survey, a much larger map of the vicinity of Baltimore has been compiled from Survey data on the same scale (1:62,500) as the Baltimore sheet. This map embraces all the Baltimore sheet, with portions of the contiguous Ellicott City, Laurel, and Relay sheets. The geology for this whole area is now completed and the map is now in course of publication at the expense of the Johns Hopkins University.

With the use of the topographic data contained on the Survey sheet Baltimore two large relief models have been made of this area upon a scale of four inches to the mile. One of these models represents the relief without vertical exaggeration, while the other has a vertical scale four times that of the horizontal scale.

The laboratory investigation of material personally studied and collected in the field has been as follows:

(1) The microscopical examination of a large suite of crystalline rocks collected along an E-W section across the Piedmont plateau in North Carolina. This section was made by your direction, in company with the State geologist, Prof. J. A. Holmes, near the end of the last fiscal year, June, 1891.

(2) A microscopial and chemical examination of the steps by which ultra-basic igneous rocks, like peridotite and pyroxenite, change to serpentine and steatite.

(3) A minute inquiry into the composition, occurrence, and origin of the veins and dikes of coarse granite (pegmatite) occurring abundantly in eastern central Maryland.

Reports on these subjects are in course of preparation and will soon be submitted to the Survey for publication.

(4) Mr. Charles R. Keyes has during the last year made under my direction a study of the eruptive granites of Maryland and will soon have a report upon his results.

(5) Mr. S. L. Powell has also commenced a study of the minerals occurring in the pegmatite veins, especially at the well known gneiss quarries at Jones Falls, Baltimore.

Early in December a part of the area covered by the Baltimore atlas-sheet was reviewed by Dr. Williams and myself. During this review the intimate relation between the configuration of the Piedmont plateau and the deposits of the coastal plain were made out in an eminently satisfactory way.

The locations of the atlas-sheets completed and noted above are shown on the accompanying pl. II.

I am, with respect, your obedient servant,

W J McGee,
Geologist in Charge.

Mr. G. K. Gilbert,
Chief Geologist.

REPORT OF MR. BAILEY WILLIS.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
APPALACHIAN DIVISION,
Washington, D. C., June 30, 1892.

SIR: I have the honor to submit the annual report of progress covering the operations of the Appalachian Division of Geology for the fiscal year now closed.

ORGANIZATION AND FIELD WORK.

The force on the pay roll of the division consisted, as during the last fiscal year, of Messrs. M. R. Campbell, C. W. Hayes, and A. Keith, assistant geologists, and of myself in charge; but the effective number for Appalachian work was reduced by the absence of Mr. Hayes, who was detailed at his own request for exploration in Alaska. There were, therefore, but two parties continuously in the field, one under Mr. Keith, the other under Mr. Campbell.

Mr. Keith was assisted by Mr. G. H. Shields, and equipped for transportation only with a buckboard and two horses. From July 9 to November 30 he worked in the Smoky mountains of North Carolina and their foothills in Tennessee. For subsistence and shelter he depended on the rude accommodations to be secured among the mountaineers, and a number of trips on foot were made to the higher domes, where he and Mr. Shields carried several days' rations and slept out. The form of outfit and method of work thus tested by Mr. Keith are economical of cash, but they involve loss of time in bad weather and much personal inconvenience.

Mr. Campbell had the assistance of Mr. J. V. Lewis, of North Carolina, and was fitted out with camp, served by cook and driver. The field of work was the Estillville atlas sheet, and he was instructed to map all details of structure and stratigraphy in the field, and to give special attention to the Big Stone Gap coal basin. There is no more important problem before this division than the stratigraphy of the coal fields, and there is much difficulty in presenting the facts upon maps in a satisfactory way as they shall be obtained. It is now proposed that we shall be guided in subdividing the Coal-measures, as we have been in the older strata, by the more apparent lithologic distinctions found in each district, without reference to the theoretical series which have been arbitrarily established for the whole Appalachian Coal-measures. Thus, in the Big Stone Gap field, two important sandstone horizons are recognized over a large area; between them and above them are productive Coal-measures. By mapping these four formations and others below them the positions of the valuable coals are indicated with all the accuracy possible on the atlas sheet scale, and numerous large scale columnar sections give the details of each formation in different parts of the field. Mr. Campbell's work was most thoroughly and carefully done, and the results soon to be published in a bulletin will be of much value. Having extended his work on to the Bristol sheet he joined me at Rogersville, Tennessee, on September 24, and thereafter accompanied me.

During July, 1891, I made a trip through Pennsylvania to familiarize myself with the facts of geology set forth by the Second Geological Survey of the State, and the month of August was passed in office work in Washington. On September 4 I started in company with Mr. C. D. Walcott, chief paleontologist, on a trip intended to settle certain problems of geologic importance, which only the discovery of fossils could decide. We stopped at Natural Bridge, Virginia; Cranberry, North Carolina; Rogersville, Knoxville and Cleveland, Tennessee; Rome, Georgia; and Gadsden, Alabama. There we parted on October 28, and Mr. Walcott returned, while I proceeded with Mr. Campbell to verify work previously done in the southern coal fields. We examined Sand and Lookout mountains, and Walden's ridge, above Chattanooga, as far as Rockwood. We parted November 1, Mr. Campbell going to Knoxville to begin compilation from his field notes, while I spent two weeks more in the coal fields and in collecting data concerning the economic resources of East Tennessee. In this work I received much assistance from gentlemen in Chattanooga and Knoxville.

Mr. Hayes returned from Alaska October 21 and reported for field work at Attalla, Alabama, October 28. He proceeded to Starr's mountain, and during a month worked out details of structure and topography in this representative of the Ocoee series.

When the allotment of funds was made to this division, instructions were given that Prof. H. D. Campbell, of Lexington, Virginia, be employed to work out the geology of the Lexington and Natural Bridge sheets, with which he was already familiar. Prof. Campbell has spent such time in the field as his other duties allowed and some progress has been made on the Lexington sheet.

OFFICE WORK.

From December 1 to June 30 the members of this division have been occupied with preparation of maps, sections and manuscript for publication. Mr. Hayes published the account of his expedition in Alaska in the National Geographic Magazine. Mr. Keith assembled the facts for a description of the stratigraphy and structure of that part of Tennessee, about 6,000 square miles, which he has surveyed. Mr. Campbell developed sections of the Coal-measures and structure of the Big Stone Gap coal field, and prepared a bulletin on this subject. At an early date I began the article on "Mechanics of Appalachian Structure," now ready for this annual. It contains the results of field and experimental study relating to structure and offers a tentative solution of the problem of Appalachian deformation.

In December I received your verbal instructions to devote consideration to the questions relating to the printing of geologic maps after the scheme of colors and patterns elaborated by the director in the Tenth Annual. Through the skill and patience of the chief engraver many difficulties have been overcome and good progress toward publication has been made.

The list of atlas sheets in different stages of preparation in this division is as follows:

Atlas sheets with geologic boundaries engraved or drawn for engraving.

Sheet.	State.	Surveyed by.
Stanton	Virginia	N. H. Darton.
Chattanooga	Tennessee	C. W. Hayes.
Kingston	do	Do.
Cleveland	do	Do.
Ringgold	Georgia	Do.
Gadsden	Alabama	Do.
Greenville	Tennessee	Arthur Keith.
Morristown	do	Do.
Loudon	do	Do.
Harpers Ferry	Virginia	Do.

Atlas sheets with geology in advanced stage of preparation.

Knoxville	Tennessee	Arthur Keith.
Mount Guyot	do	Do.
Maynardville	do	Do.
Stevenson	Alabama	C. W. Hayes.
Rome	Georgia	Do.
Fort Payne	Georgia-Alabama	Do.
Dalton	Georgia	Do.
Estillville	Virginia-Kentucky	M. R. Campbell.

As the force of this division gains experience and knowledge of the field the revisionary work done by the geologist in charge becomes alike unnecessary and unsatisfactory. Recognition of this fact has led to further changes in methods, by which greater accuracy is secured, and the time hitherto devoted to revision can be saved for other purposes. The assistant geologists working in specific atlas sheets are instructed to plat the details of areal geology fully on the map, leaving nothing for inference or addition from notes to be compiled in the office. By this method the first work on an atlas sheet will take longer, but repetition of work will be avoided.

Very respectfully,

BAILEY WILLIS,
Geologist in Charge.

Mr. G. K. GILBERT,
Chief Geologist.

REPORT OF MR. GEORGE H. ELDRIDGE.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
FLORIDA DIVISION,
Washington, D. C., June 30, 1892.

SIR: I have the honor to submit herewith a report of the work of this division for the fiscal year ending June 30, 1892.

During this period the field force, in addition to myself, consisted of Mr. Lawrence C. Johnson, Dr. Edmund Jüssen, and Mr. A. Buford, together with the requisite camp hands. Mr. Johnson continued with the division during the entire year; Dr. Jüssen resigned on February 15; Mr. Buford joined the division on September 15. The economic results of the field work have been materially enhanced by the cooperation of Mr. T. M. Chatard, of the Division of Chemistry.

The original object of the survey of the state, namely, the mapping of geologic formations, the construction of sections showing the stratigraphy, and the investigation of phosphates, has been strictly adhered to. During the months of July, August, and September, 1891, the division was employed in office work, collating the data obtained the previous season over the various parts of the state. During the month of June, 1892, the division has been similarly employed on the data of the last season. Field work has occupied the remaining months of the year.

The investigations of the division include: The geology of the state west of the Appalachicola river, chiefly by Mr. Lawrence C. Johnson; the measurement of a section along the Appalachicola river from Columbus, Georgia, to Appalachicola, on the gulf, embracing formations from the Cretaceous upward, by Messrs. Johnson and Jüssen; a similar section from the Georgia line to the Gulf along the Suwanee river, by Dr. Jüssen; the completion of the geology between these two rivers, by Messrs. Johnson and Jüssen; the study of parts of Lake, Orange, Brevard and Volusia counties, with special reference to the occurrence of either Archean rocks, or ores, by Mr. Johnson, and the economic investigations chiefly by myself assisted by Mr. Buford.

The economic investigations were conducted, more particularly, in the regions of the land and river pebble phosphates, extending from Lakeland southward, but the hard-rock district received its share of attention. The study of the phosphates included the character of the deposits and their origin, the methods of mining, and the processes to which the mined product is subjected in preparation for the market. In addition to the foregoing, Mr. Johnson has spent a month in the peculiar plate-rock deposits, with special reference to their lines of limitation. Besides these studies, he has made a general examination of the so-called kaolin beds across the central portion of the state, and Mr. Buford an examination of an extended area in the vicinity of the

Chipola river, in western Florida, with special reference to determining the presence or absence of phosphates of economic value.

The present state of geological work in this division is, therefore, as follows: The data exist for mapping the general geology of the state from the Suwanee river to the Alabama line; by the geological river sections and the examination of the adjacent areas it is possible to correlate the Florida formations with those of Georgia and Alabama, and so make the geology of the western portion of the State one with that of the coastal plain of southeastern United States; geological work has been entered upon on the eastern side of the peninsula; the investigation of the phosphates is in such a state that another season's work will permit a complete report on their geology, mining and preparation for market. This industry has also received due attention from the mercantile standpoint.

Prior to resuming field work the past season, I prepared a general statement regarding the phosphates of Florida, which embodied the results of the preceding season. The matter presented included the topographical features and a geological sketch of the state; a description of the phosphate deposits, with their origin and development to the present stage, and a short discussion of the chief chemical constituents of the several classes of phosphates, with analyses by Dr. T. M. Chatard. The paper embodying this information is entitled "A Preliminary Sketch of the Phosphates of Florida." By permission of the director of the Geological Survey it was presented at the Baltimore meeting of the American Institute of Mining Engineers, February 16, 1892. It appears in volume 20 of the Transactions of the Institute.

Careful collections have been made during the season in the various parts of the state in which work has been conducted, and ample material has been acquired for the prosecution of the chemical studies which should complement the geological.

Very respectfully, your obedient servant,

GEO. H. ELDRIDGE,
Geologist in Charge.

Mr. G. K. GILBERT,
Chief Geologist.

REPORT OF PROF. C. R. VAN HISE.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
LAKE SUPERIOR DIVISION,
Madison, Wisconsin, June 30, 1892.

SIR: I beg to submit the following report of the operations of the division of the Survey under my charge for the fiscal year ending today:

Three lines of work have been followed: First, detailed studies of regions of exceptional scientific interest or economic importance, leading to special reports; second, areal mapping for atlas sheets; and third, a general study of the pre-Cambrian rocks of North America.

FIELD WORK.

The following persons have had charge of parties in the field: W. S. Bayley, F. P. King, W. N. Merriam, E. R. Maurer, E. B. Mathews, H. L. Smyth; and aside from these men there have been a number of other geological field assistants.

W. S. Bayley, with George E. Luther and F. P. King as geological assistants, during the summer of 1891 had charge of the party which is engaged in a detailed study of the Marquette iron-bearing district. This small area lies in four different atlas sheets, and an accurate knowledge of its structure is a key to the region. In the areas of comparatively simple geology the work was done by making systematic traverses at short intervals. In the parts in which the iron-bearing formations occur the locations were by plane-table methods, an assistant occupying a plane-table station and locating the geologist at every point at which it was desirable to do this. At the same time this assistant, without additional expense, made a large scale topographic map of the area within his range.

The study of the Marquette district was resumed the first day of June by a party in charge of E. B. Mathews, with H. F. Phillips as field assistant. This work is now so far advanced that it is expected it will be finished the present season.

James R. Thompson has, in the Marquette district, been studying the structural relations of the iron ores and the detailed structure of the iron-bearing formation.

In July a small party in the charge of F. P. King finished working out the areal geology of the pre Huronian rocks for the atlas sheets south of the Marquette district, bounded by parallels 46° and 46° 30′ and meridians 87° and 88°.

Two geological parties in the charge of E. R. Maurer, including eight geological assistants, were in the field at the beginning of the fiscal year. They remained until the middle of November. Their task was the areal work of the atlas sheets bounded by parallels 46° and 46° 30′ and meridians 88° and 89°. This is a heavily forest-covered region of Huronian rocks which connects the Marquette and Menominee iron districts. An area of about 1,025 square miles was gone over by systematic traverses at intervals of one-fourth of a mile. This closeness of traversing was necessary because of the sparseness of ledges and the necessity for getting all available information in order to work out the geology of this heavily drift-covered but economically important district.

This general system of traverses is being supplemented at the present time by two parties in the charge of W. N. Merriam and H. L. Smyth, the first having as a geological assistant E. R. Maurer, and the second, S. Sanford. These parties began work the first of May. Their study is confined to a review of critical localities and to a closer mapping of the iron-bearing formations than was possible by the simple traverses.

My time was largely taken in the supervision of the geological parties already mentioned. Aside from these, however, in company with Mr. A. C. Peale, I visited, in the early part of July, the critical points of the geology of the Three Forks sheet in Montana. In the early part of August, Raphael Pumpelly and I visited again the original Huronian of the north shore of Lake Huron, and also for the first time saw the original Laurentian area of the Laurentides, in order that we might be able to compare more accurately the original Huronian and Laurentian rocks with the series correlated with them in the United States.

OFFICE WORK.

W. S. Bayley has continued through the year, as his major work, the study of the gabbros of the Lake Superior region. In addition to this he has given some assistance in connection with the educational series of rocks. The study of the gabbros is far advanced, and it is hoped that a report upon them can be turned in the next fiscal year. My own work has been the completion of the correlation paper on the Archean and Algonkian and a study of the Marquette material in reference to the preparation of a monograph upon this district. All of the field work has been platted, the specimens have been examined, and the field determinations revised. The work of platting has been mainly done by William Kramer, W. S. Bayley, and E. R. Maurer. The determinations of the rocks for the areal geology are my own. Mr. Luther has had charge of the clerical work of the office.

PUBLICATIONS.

Incidentally to our studies the following articles have been unofficially published:

Eleolite-Syenite of Litchfield, Maine, and Hawes's Hornblende-Syenite from Red Hill, New Hampshire, by W. S. Bayley. Bull. Geol. Soc. of America, vol. 3, pp. 231-252.

A Fibrous Intergrowth of Augite and Plagioclase, resembling a reaction rim, in a Minnesota gabbro, by W. S. Bayley. Am. Jour. Sci., vol. XLIII, 3d ser., 1892, pp 515-520.

Notes on the Petrography and Geology of the Akeley Lake Region, in northeastern Minnesota, by W. S. Bayley. 19th Ann. Rept. Geol. and Nat. Hist., Survey of Minn. for 1890, pp. 193-210.

The Iron Ores of the Marquette District of Michigan, C. R. Van Hise. Am. Jour. Sci., 3d ser., vol. XLIII, 892, pp. 116-132.

Observations upon the Structural Relations of the Upper Huronian, Lower Huronian, and Basement Complex on the north shore of Lake Huron, by Raphael Pumpelly and C. R. Van Hise. Am. Jour. Sci., 3d. ser., vol. XLIII, pp. 224-232.

The Iron Ores of the Lake Superior Region, by C. R. Van Hise. Wisconsin Acad. Sci., Arts and Letters, vol. VIII, pp. 219-228.

The more important scientific conclusions contained in these publications are, first, that the original Huronian rocks are separable into two unconformable series. Thus the original Huronian accordingly corresponds in its major division with those of the Huronian rocks on the south shore of Lake Superior. Second, it has been ascertained that the laws which controlled the deposition of the iron-ore deposits of the Penokee district, published in the Tenth Annual Report, are applicable to all of the districts of the Lake Superior region which are now producing iron ore.

In the hands of the Public Printer are the following:

The Penokee Iron-Bearing Series of northern Michigan and Wisconsin, by Roland D. Irving and C. R. Van Hise. Monograph U. S. Geol. Survey, vol. XIX.

Correlation Papers—Algonkian and Archean, by C. R. Van Hise. Bulletin No. 86 U. S. Geol. Survey.

The Eruptive and Sedimentary Rocks of Pigeon Point, Minnesota, and their contact phenomena, by W. S. Bayley: Bulletin No. ——, U. S. Geol. Survey.

Very repectfully,

C. R. VAN HISE,
Geologist in Charge.

Mr. G. K. GILBERT,
Chief Geologist.

REPORT OF PROF. T. C. CHAMBERLIN.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
GLACIAL DIVISION,
Madison, Wisconsin, July 1, 1892.

SIR: I have the honor to submit the following report of work of my division for the last fiscal year:

The opening of the year found Assistant Geologist Leverett engaged in tracing out more completely than had been previously done the boundaries in western Indiana and southern Illinois of the later ice incursion marked by vigorous drainage conditions, as distinguished from the earlier invasions marked by slack drainage conditions. This work was completed for the area then undertaken late in July. Mr. Leverett then renewed the tracing of moraines in western Ohio, taking up the work where it had been suspended at the close of the field season of 1890. This occupied him till early in October. In connection with this work he traced to their eastern termini the upper, the second, and the third beaches formed by glacial waters in the western part of the Erie basin. He found them replaced at the east by moraines and made a careful study of their junction and relationships. He also studied the silts of the Cuyahoga basin and made important determinations of their genetic relationships. During the winter Mr. Leverett prepared the manuscript of two bulletins and brought that of a third to an advanced stage. These treat of the Grand river, the Scioto, and the Maumee-Miami glacial lobes respectively.

Assistant Geologist Upham has been engaged almost the entire year upon his monograph on the Pleistocene deposits of the Ancient Lake Agassiz basin and adjacent region. A final copy of this is now being drawn off and revised and will soon be ready for submission to you.

Prof. R. D. Salisbury has been engaged upon the Pleistocene formations of New Jersey in the employ of the geological survey of that State, and has therefore been engaged on the National Survey for but a very limited time. This limited service was given chiefly to studies on the west side of the Delaware river supplementary to the New Jersey work, and related particularly to the investigation of old drift lying south of the well known terminal moraine that crosses the river near Belvidere. An assistant to Prof. Salisbury has, during the latter part of June, traced out the glacial gravels on the west side of the Delaware from the Belvidere moraine south to Trenton and made some observations incidentally upon the old drift on the highlands back from the river.

Mr. Schroeder, temporarily assigned by you to work under the immediate direction of Prof. Salisbury, has done some mapping of the Pleistocene formations on the Madison (Wisconsin) sheet, the topography of which had been previously prepared by the Topographic Division of the Survey.

Prof. Salisbury spent about two weeks of the holiday season in an examination of the silts and gravels of the lower Mississippi basin at selected points for the purpose of supplementing our previous joint studies upon those deposits.

Mr. I. M. Buell has completed his field work on the bowlder trains of central and southern Wisconsin, and his report is in an advanced condition.

The most of the limited time I have given to the service of the Survey has been consumed in administrative duty. The small amount of field work I have done has been chiefly connected with the work of other members of the Survey, and was advisory in nature or supplementary to work previously done and hardly merits specific mention here.

Very respectfully submitted,

T. C. Chamberlin,
Geologist in Charge.

Mr. G. K. Gilbert,
Chief Geologist.

REPORT OF MR. W. P. JENNEY.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
DIVISION OF ZINC,
Chicago, Illinois, June 30, 1892.

SIR: I have the honor to submit the following report of the work under my charge in the investigations of the deposits of lead and zinc ores in the mining region of southwest Missouri for the fiscal year ending June 30, 1892.

The field work of the previous year was continued from July 1, 1891, until the latter part of December. The new developments of interest in the older mining camps of the Southwest were examined in detail, the extent of the lead and zinc bearing formation was approximately determined in southern Missouri and in its continuation into northern Arkansas, the northeastern part of Indian territory, and the southeastern corner of the state of Kansas, completing the field work necessary for the preparation of the final report.

In order that the lead and zinc mines of this section might be compared with those of the upper Mississippi valley, the mining regions in the vicinity of Dubuque, Iowa; Galena, Illinois; and Mineral Point, Wisconsin, were visited, and the more prominent deposits both of lead and zinc ores examined, so far as they were open for inspection.

The period from January 1, 1892, untll April 30, 1892, was employed in the preparation of manuscript for the final report of the results of the investigation.

May and June, 1892, were devoted to field work in the comparative examinations of the lead mines of southeastern Missouri and southern Illinois.

Valuable asssistance was rendered by Mr. F. A. Sampson, of Sedalia, Missouri, and by Mr. Henry Newman, of Joplin, Missouri, who volunteered their services in the work in the field.

I also desire to express the indebtedness of the Survey for the aid and assistance in the progress of the work given by Dr. John H. Britts, of Clinton; Prof. Edward M. Shepard, of Springfield; Dr. R. A. Blair, of Sedalia, and Mr. James A. Reeves, of Joplin, Missouri.

Very respectfully submitted,

W. P. JENNEY,
Geologist in Charge.

Mr. G. K. GILBERT,
Chief Geologist.

REPORT OF MR. A. C. PEALE.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
MONTANA DIVISION,
Washington, D. C., July 1, 1892.

SIR: I have the honor to submit the following report of operations of the Montana Division for the year ending June 30, 1892:

FIELD WORK.

The field work of the year was in continuation of the work begun during the last month of the preceding fiscal year, viz, the reexamination of certain portions of the area included within the limits mapped on the Three Forks sheet, with a view to revision before finally coloring the map geologically.

A portion of July was spent in the study of the principal Archean and Algonkian areas of the sheet, mainly on the western half. Prof. Van Hise joined me the latter part of June and accompanied me on a trip to the Upper Madison valley and to the vicinity of the head of the Missouri river. We also visited Butte and Helena in order to compare the granite of Butte and the Main range with the granite of the region near the Revenue mine, in Madison county.

The line of faulting west of Salesville, between the Gallatin and Madison rivers, was next mapped, and the remainder of the month of July was spent in the area north of the Jefferson river, within the limits of the northwest corner of the map, when a careful investigation was made of three fault-lines that cross the Jefferson river. During August the region south of the Jefferson river, between Antelope creek and the west line of the map, was the field of work, and, after mapping the complicated folds of the sedimentary rocks of this area and extending the lines of the Jefferson river faults westward, the westward continuation of the granite area of Sterling and Revenue was traced. During the latter part of the month some additional data were secured relating to the Cambrian exposures near Logan, on the East Gallatin river.

This completed the season's work and the field party was disbanded early in September, after which I returned to the office in Washington.

OFFICE WORK.

The office work of the year, in addition to routine work, has consisted of the preparation of the reports on mineral water statistics for the years 1889, 1890, and 1891, which will be published in "Mineral Resources of the United States," by Mr. David T. Day.

Respectfully,

A. C. PEALE,
Geologist in Charge.

MR. G. K. GILBERT,
Chief Geologist.

REPORT OF MR. ARNOLD HAGUE.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
YELLOWSTONE NATIONAL PARK DIVISION,
Washington, D. C., June 30, 1892.

SIR: I have the honor to submit herewith the following report of field and office work conducted under my charge during the year ending June 30, 1892.

FIELD WORK.

During the summer and autumn of 1891 field work was prosecuted in Montana and Wyoming. On May 20, 1891, I authorized Mr. Walter H. Weed to proceed to Red Lodge, Montana, to make a preliminary examination of the well known Rocky fork coal field, with special reference to the extent of the coal rocks and the position of the workable coal seams. The field lies south of the Yellowstone river along the base of the Bear Tooth mountains. Red Lodge is situated in the center of an active and growing industry; it is the principal settlement, and may be reached by a branch line of the Northern Pacific Railroad from Billings, Montana, the road running up Clark's fork. Mr. Weed remained there between two and three weeks, tracing out the coal formations and determining the productive coal seams.

From Red Lodge he proceeded to Great Falls, Montana, on the Missouri river, for the purpose of studying the extensive coal regions south of that locality, along the northern base of the Little Belt mountains. As these coals lie near the base of the Cretaceous, they are much older than any other productive coal fields in Montana. Mr. Weed was able to determine their geological relations to the Carboniferous and Jura Trias below, and to the Fort Benton shales above, and their flora correlates them with the Kootanie horizon of Canada. The geographical position of these coals with reference to the mining centers of Montana makes them of the highest value to the future industrial progress of the state. There can be no question that this formation covers a very large area; it is important that its geological position should be clearly defined.

After completing his work at Great Falls, Mr. Weed proceeded to Bozeman, Montana, where he equipped a camping party for field work in the region lying between the Snowy, Gallatin, Bridger, and Crazy mountains. Geologically it is a complicated region, but most important from an economic point of view, as it is everywhere underlain by Cretaceous coal rocks. The work of tracing out the coal formations in the Yellowstone valley and along the east side of the Bridger range was continued from the previous season. The study of the structural relations and physical history of these rocks occupied a large part of midsummer.

Owing to official duties I was prevented from taking the field until late in the summer. On September 1, accompanied by Mr. Joseph P. Iddings, I left for Montana. Mr. Iddings resumed his work of the previous year in both the Snowy and Crazy mountains, giving special attention to the system of radial dikes from a central core of crystalline rocks that make up a large part of the latter mountains. Before leaving the field in the autumn he finished the necessary surveys along the southern spurs of the Crazy mountains sufficiently to enable us to complete the Livingston sheet for the geological map of the country. Only a small portion of the Crazy mountains lies south of the forty-sixth parallel, the northern boundary of the Livingston sheet.

Mr. Weed joined me at the Mammoth Hot Springs, and together we spent a month in the southern part of the park and the country immediately adjoining on the south. Through the kindness of the United States engineer officer in charge of construction of government roads and bridges in the park, I had the use of a small steam launch to examine the shores of the Yellowstone lake. The launch proved of great service in a work I had long wished to undertake. Considerable time was devoted to a study of the shore line of the old lake and the ancient outlet. I also devoted considerable time to a study of the glaciation of the southern end of the park and the extreme northern spurs of the Wind river mountains that extend into the park.

Returning from Jacksons lake, just south of the park, the principal geyser basins were revisited, which gave Mr. Weed an opportunity to continue his annual observations upon changes going on in the most active hot-spring areas.

After leaving the park I spent a week with Mr. Weed in going over his work in the Yellowstone valley near Livingston, examining the Laramie coal rocks and overlying Livingston formation on both sides of the river, all the way from Big Timber to the Muir tunnel in the Bridger range.

I reached Washington late in October, after a short but successful season. Upon the completion of their field work, both Mr. Iddings and Mr. Weed returned to office duties, reaching Washington about the middle of November.

OFFICE WORK.

All the various branches of office work have progressed steadily and satisfactorily. I have been occupied upon several different chapters of the monograph upon the Yellowstone park, the preparation of the geological map of the park, and the Livingston and Crazy mountains sheets to the north of the national reservation. These matters, together with the usual routine work, have occupied my time for several months.

My report upon the Geology of the Eureka District, which was submitted last year, is now going through the press. It will appear as Monograph XX of the Geological Survey publications.

Mr. Weed presented the most important results of his examination of the Great falls and Rocky fork coal fields in a paper read before the Geological Society of America. The paper has been published as a bulletin of the Society, under the title, "Two Montana Coal-fields." Mr. Weed has also prepared two papers for publication by the Geological Survey, and in May last I had the honor of transmitting them with the recommendation that they be printed as bulletins of the Survey. One is entitled "Glaciation of the Yellowstone Valley north of the National Park." The elevated region of the Yellowstone park was, in glacial time, covered by ice, sending out its glaciers both to the north and south. The northern glacier emerging from the park entered the broad valley near the junction of the Yellowstone with the Gardiner river, and it is here that Mr. Weed's work begins. His paper is the result of his studies of the glaciation of the valley, and is, so far as I am aware, the first detailed study of such phenomena in an inclosed mountain valley in the Rocky mountains.

The other is entitled, "The Laramie and overlying Livingston formation in Montana, with a report upon their Flora, by Mr. Frank H. Knowlton." I regard this as a most important paper bearing upon the physical history of the Rocky mountains during late Cretaceous time.

Mr. Iddings has been engaged upon an elaborate petrographical study, showing the relations of dike rocks to massive cores and extrusive flows. His observations made in the Yellowstone park and the immediate neighborhood bearing upon this subject are most important.

On May 7, Mr. Iddings read a lengthy paper before the Philosophical Society of Washington entitled, "The origin of igneous rocks." It is largely historical, being a critical review of the opinions advanced by geologists during the last thirty years to account for the great variations in lavas from any given center. Mr. Iddings discusses a large amount of material gathered from all parts of the world wherever careful work has been done upon volcanic areas, but the most instructive portions of his paper are drawn from observations and results in the Yellowstone park and the Absaroka range. He discusses over sixty chemical analyses of rocks made for the Yellowstone park division in the chemical laboratory of the Survey.

On May 22, Mr. Weed left for Montana to resume field work on the Cretaceous rocks that encircle the Crazy mountains. It is too soon, however, to report any results of this season's survey.

Very respectfully, your obedient servant,

ARNOLD HAGUE,
Geologist in Charge.

Mr. G. K. GILBERT,
Chief Geologist.

REPORT OF MR. S. F. EMMONS.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
COLORADO DIVISION,
Washington, D. C., June 30, 1892.

DEAR SIR: I beg to submit the following report of survey work done under my direction during the fiscal year 1891–'92.

Mr. Eldridge having been permanently assigned to the investigation of the phosphate deposits of Florida, my scientific corps now consists only of Mr. W. Cross and myself.

During the last week of the month of August there was held in this city the Fifth Triennial Session of the International Congress of Geologists. This meeting brought together here over 250 members of the Congress, of whom 78 were distinguished foreign geologists representing 24 different countries outside of the United States. At such meetings it is customary for the resident geologists to consider those coming from the other parts of the world as their scientific guests, and to do everything in their power to make their visit instructive, by offering them every possible facility to study the geology of the country visited. The meetings thus promote not only the advancement of geological science but also the instruction of the individual members by permitting an interchange of views in the actual presence of the geological phenomena under discussion.

As Mr. Cross and myself were both secretaries of the congress, much of our time during the months of July and August was occupied in preparing for the reception of the foreign geologists. Under the authorization of the Director I undertook the labor of compiling and editing, from notes furnished by different geologists, largely members of the Survey, who were most familiar with the respective regions, a geological guidebook for the western excursion of members of the Congress. This excursion, which involved a railroad journey of over 6,600 miles, was calculated to enable the traveller to see the typical and most important geological phenomena of the Appalachian and Rocky mountain systems and of the great interior valley. The descriptions contained in the guidebook, therefore, form an epitome of the geological history of the greater part of the United States as derived from the latest investigations, and thus give it a permanent value beyond the immediate purpose for which it was prepared, since it will long be of use to all interested in the geological structure and natural resources of the regions discussed.

From the 2d to the 20th of September we accompanied the excursion party for the purpose, not only of acting as guides to the foreign geologists, but also of studying, under the guidance of those more familiar with the regions than ourselves, the geological phenomena of regions we had not hitherto had opportunities of examining.

During the remainder of the month of September and in October

I visited the mining districts of Leadville, Aspen, and Butte. At the former point I gathered further data, from explorations which had been made by different mines since my former visit, in regard to the geological structure of this region, with special reference to the probable location of ore bodies in portions of the district which had not yet been explored.

At Aspen a topographical party under Mr. Morris Bien had been occupied during the summer in making a detailed map of the region, which should serve as the basis for a geological study of the mineral-bearing region, which the Director proposes to have made at some future date. My work here consisted in a preliminary examination of the underground workings of some of the important mines for the purpose of estimating the probable extent of the rich ore development, and thus determining the area and scale of the maps to be made, and obtaining from mine owners copies of the surveys of their mine workings, which might be compiled upon a common scale during the winter months.

At Butte I made an examination among others of the Bluebird mine, for the purpose of studying some new and unusual phenomena in the structure of fissure veins which had recently been developed there, and which I feared might, through abandonment of drifts, become inaccessible before another opportunity of examining the mine presented itself.

During this time Mr. Cross made a preliminary examination of an important and hitherto unobserved series of rocks which he had detected near Salida in the summer of 1888. These rocks are older than any sedimentary beds hitherto recognized in the Rocky mountain region, and yet are distinctly different from the Archean crystallines. He traced them from the southern end of the Mosquito range across the Arkansas valley, to the Sangre del Cristo range. It is impossible, owing to the imperfection of existing geological maps, to determine definitely the geological relations of this important series of rocks without making any areal survey of the latter range.

From this region he visited Wagon Wheel gap to complete his studies of the spherulites of Colorado, and, at my request, visited the new mining district of Creede, which I thought, from what I knew of its general geological relations, was likely to prove of economic importance. His examination showed that large and rich deposits were already opened in decomposed eruptive rocks, but that it would be impossible to obtain a sufficient knowledge of the geological structure of the region to furnish data of any practical value except by a somewhat detailed study of the region based upon an approximately accurate map.

Later he made a somewhat detailed study of the post-Laramie deposits of Middle Park, with their associated eruptives, which are important in connection with the survey of the Denver basin region, and whose examination in the previous summer had been cut off by an early snowfall. Attention was first called to these beds by A. R. Marvine, who surveyed the region in 1873. He considered that they corresponded to the coal-bearing Laramie horizon, but discovered a distinct unconformity between them and the underlying Cretaceous formations. The fact that no other instance has been discovered of such an unconformity has given exceptional interest to this region, and it has suggested itself that in a preliminary survey in a geologically unknown region Mr. Marvine might have been at error in some part of his determination, his early death having prevented the second examination of it, which he undoubtedly would have made had an opportunity presented itself. His accuracy as a stratigraphical observer was so well known and his demonstration of the unconformity so clear that no doubt has ever been entertained of its existence. The only possibility of error was, therefore, in his determination of the beds as of Laramie age, which was based on the somewhat uncertain evidence of plant remains. The discovery of a series of beds in the Denver basin that overlie unconformably the coal-bearing Laramie, and yet correspond to no hitherto recognized Tertiary formation of the Rocky mountain region, led to the suggestion that the so-called Laramie of the Middle Park corresponds to this series of beds, which seem partly to fill the gap that paleontological evidence shows to exist between the lowest known Eocene beds and the Laramie proper. It was the determination of this correspondence, to which he was peculiarly fitted by his detailed studies of the Denver beds, that Mr. Cross's examination was devoted, and its results will appear in the forthcoming Denver basin report.

OFFICE WORK.

The remainder of the year has been devoted to office work. Of the various publications in course of preparation which were outlined in my previous annual report those on the Ten Mile and Silver Cliff mining districts and on the Denver Basin region have, for various reasons which it is not necessary to enumerate here, not yet been handed to the printer. The geological maps which accompany them have been drawn and are ready for geological color-printing.

The double atlas-sheet map of the Crested butte or Southern Elk Mountain region has been engraved and the geological outlines have been finally drawn upon it.

In addition to the regular office work, I have written during the year a short account of the important and unique fluorspar deposits of southern Illinois, which I had an opportunity of visiting without expense to the Survey. Mr. Cross has also prepared a paper, which will appear shortly in the American Journal of Science, reviewing and discussing all the evidence that has yet been published with regard to the age of the Denver beds mentioned above, in the hope that it may bring about a more complete accordance on this subject between stratigraphers and paleontologists.

Very respectfully,

S. F. EMMONS,
Geologist in Charge.

MR. G. K. GILBERT,
Chief Geologist.

REPORT OF MR. J. S. DILLER.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
CASCADE DIVISION,
Washington, D. C., June 30, 1892.

SIR: Herewith I have the honor to submit my annual administrative report of the Cascade Division.

FIELD WORK.

At the beginning of the fiscal year there were two parties in the field; I had immediate charge of the one in the Taylorville region of northern California; the other, in southern Oregon, was in charge of Mr. W. Q. Brown.

I had the assistance of Mr. E. G. Paul and Mr. James Storrs, and my party remained in the field until October 17. Prof. Alpheus Hyatt, paleontologist in charge of the Jura-Trias, was with me during the greater part of July and August. While he collected fossils, and correlated and identified horizons, I sought for new localities of fossils and studied the stratigraphy. In this way we were able to cover the ground much more thoroughly than would have been possible by any other plan, and the results secured strongly recommend such cooperation.

The special topographic map of the Taylorville region prepared by Mr. Dunnington on the scale of 2 inches to a mile, enabled us to map the geologic formations in considerable detail. There were 31 sedimentary and 17 eruptive masses outlined within an area of 100 square miles, and among these 1 horizon in the Silurian, 2 in the Carboniferous, 3 or more in the Trias, and 5 in the Jura were definitely recognized by fossils. The Paleozoic horizons were determined by Mr. Walcott, and one fossil plant bed at the top of the Trias by Prof. Fontaine.

Four sections, one of which was 17 miles in length, were measured. These involved over 20,000 feet of folded strata, by far the larger part of which are Paleozoic.

The results of the work in the Taylorville region are set forth in a paper read before the Geological Society of America at Columbus, Ohio, December 29, 1891, and are published in its bulletin (vol. 3, pp. 369–394).

In southern Oregon, Mr. W. Q. Brown, during July, August, and September, mapped the metamorphic rocks, earlier and later Cretaceous, and other still later sedimentary formations, as well as recent eruptives throughout a large part of the country embraced in the Ashland and Grant's pass sheets. Besides the cartographic work, he collected fossils at numerous localities.

Early in March last it was determined to begin work in the state of Washington, and Mr. I. C. Russell was assigned to me for duty in that field. Mr. Russell left Washington, D. C., March 24, with instructions to proceed to North Yakima, Washington, and study the geologic structure of that region with special reference to its artesian resources. I followed April 1, and found him already outfitted in camp and the work well begun. With the assistance of Mr. Samuel Storrow he has mapped the Yakima and other basins, embracing almost the whole country lying between the great bend of the Columbia and the Cascade range.

Lake beds which fill most of the valleys contain an important part of the water supply of the country. To these Mr. Russell has given special attention. They rest upon a series of eruptive rocks, with which they have been so folded as to form basins. Mr. Russell's detailed study of these basins will enable him to determine the limits of artesian water in each basin, and his investigations have a direct and important bearing upon the agricultural resources of the country.

During April I made a general reconnoissance of Washington, giving special attention to the distribution of the coal-bearing rocks and those which are metamorphic, containing the valuable metalliferous deposits. Many mines and other localities were visited, and Miocene, Eocene, and Cretaceous fossils collected.

In May my reconnoissance extended into western Oregon. Collections were made chiefly from the newer fossiliferous strata in order to establish horizons from which to work out the geologic structure of the country. While in Eugene I examined Prof. Condon's large and excellent collection of fossils from various parts of Oregon and obtained from him a map showing the distribution of the formations as far as they could be made out certainly from his observations. This data from Prof. Condon.will form a valuable contribution of new material for the next edition of Mr. McGee's geologic map of the United States.

June was spent in Shasta county, California, where I had the assistance of James Storrs. The areal geologic work upon the northwestern part of the Lassen peak sheet has been completed.

OFFICE WORK.

While in the office at Washington, from November to March inclusive, I was engaged chiefly in elaborating my notes upon the geology of the Taylorville region and preparing the paper already mentioned.

All of the cartographic results of the geologic work which has yet been done in northern California, Oregon, and Washington by J. Stanley-Brown, Will Q. Brown, I. C. Russell and myself have been transmitted to Mr. McGee for the new edition of his geological map of the United States.

PETROGRAPHIC LABORATORY.

Among the material submitted to the petrographic laboratory for study only two collections deserve mention.

A mica-peridotite sent by Mr. Ulrich, of the state geological survey of Kentucky, has been studied and described. It is a new type of eruptive rock, and my paper upon it is now in course of publication in the American Journal of Science.

Mr. G. K. Gilbert submitted a collection of rocks from Coon butte, Arizona. Some of the specimens produced by the aqueo-igneous fusion and inflation of a sandstone are of special interest on account of their resemblance to volcanic pumice.

The educational series of rocks is almost completed. Only a few specimens from the vicinity of Washington are yet to be obtained. During the year syenite of Arkansas, hematite of New York, hornfels of California, and stalactites of Luray caverns, Virginia, were collected. There are now over 30,000 specimens on hand. The trimming and numbering are being carried rapidly forward by W. S. Hunnell and E. G. Paul. On account of the pressure of other duties the preparation of the bulletin to accompany the educational series of rocks has been somewhat delayed.

Messrs. Hermann Ohm and Fred. C. Ohm have been engaged continuously throughout the year in the preparation of thin sections of rocks for study in the various divisions of the Survey. Mr. Hunnell, who has immediate charge of the laboratory, and also Mr. Paul, have frequently assisted in the preparation of sections. During the year about 4,800 thin sections were made and 108 specimens ground and polished for investigation. Nearly 5,000 specimens of the educational series have been trimmed within the year and an equal number painted ready for numbering.

Very respectfully, your obedient servant,

J. S. Diller,
Geologist in Charge.

Mr. G. K. Gilbert,
Chief Geologist.

REPORT OF MR. G. F. BECKER.

Department of the Interior,
U. S. Geological Survey,
California Division,
Washington, D. C., June 30, 1892.

Sir: During the last fiscal year the attention of my division has been chiefly devoted to the geology of the gold belt of California, which is regarded as substantially embracing the western slope of the Sierra between latitudes 37° 30′ and 40°.

As heretofore, Messrs. H. W. Turner and W. Lindgren have been employed chiefly in the cartographical portion of the investigation, my own attention being devoted to the solution of the geological problems arising in the work. One of the most interesting of the many problems there presented is the structure of the range, which is almost everywhere intersected by joints and partings. Masses thus characterized pass over into schistose and slaty aggregates. I have completed an investigation on this subject, in which, to the best of my belief, the equivalence of these various phenomena is proved and their relations to one another shown. Without such investigation it would be impossible correctly to interpret the meaning of the various manifestations of dynamic action; without such interpretation it would be impossible to give a rational account of the occurrence and distribution of ore-deposits, which are always most intimately connected with dynamic manifestations.

The geological mapping has made good progress. Messrs. Turner and Lindgren have completed the cartographical representations of six sheets of the area, each covering one-fourth of a square degree. As I have convinced myself by careful inspection, this work has been performed with great intelligence and with the utmost fidelity. These six sheets by no means represent the entire area mapped, for it is seldom convenient to carry on the work within rectangular outlines, facilities of communication and similarities of formation assigning natural boundaries of irregular outline. As a consequence, portions of a number of other sheets are also done. The six sheets referred to are accurately colored, and show structural features and the distribution of ore deposits, as well as the outlines of the various rocks.

It is, nevertheless, not possible to submit these maps for publication immediately on account of the uncertainty of the age of some of the sedimentary masses which have been mapped. One of the great difficulties in the investigation of the gold belt arises from the extremely small number of fossil localities known in spite of most careful search, and to this must be added difficulties arising from the equivocal indications of some of the few fossils discovered.

Particularly in the Mesozoic series there is little or no analogy between the fossil faunas of California and those of the region east of the Rocky mountains, and for analogous forms it is necessary to turn westward to Russia. Russia and California, however, are separated by so great a distance that inferences from one to the other must be treated with the greatest caution. Furthermore, the collections of Russian fossils accessible in this country are extremely meager.

To remedy this defect in the collections of the National Museum the Director, at my request, has made application to the paleontologists at Moscow, through his excellency Mr. C. de Struve, the Russian minister at Washington, to supply us with fossils from the Jura and Cretaceous of Russia. When these collections are received they will unquestionably be of material aid in determining the age of the analogous horizons of the gold belt.

Further to promote these determinations I engaged the assistance of an extremely expert fossil collector, Dr. Cooper Curtice, during the past summer. He succeeded in making collections of great value both in the Paleozoic and Mesozoic beds, greatly enriching the faunas previously known from these rocks. He is deserving of the warmest thanks for the ability and energy that he displayed in this very difficult task. In spite of the value of his contributions, however, further work in the same direction must be prosecuted during the present season, and the formations can not be finally named on the maps until definite results have been reached. In the mean time the cartographical work will proceed with undiminished energy.

The ideal method of preparing a geological map of a country is to enlist the cooperation of resident geologists, when there are such with education and ability sufficient for the task. This method is impracticable as a rule in the western portion of the United States, but I have secured the assistance of Dr. Andrew C. Lawson, associate professor of geology in the University of California, who has undertaken to map the region near the bay of San Francisco. Prof. Lawson will employ his vacation and holidays in this work, and will be able to avail himself of the aid of students, and perhaps of colleagues, interested in the subject. The area which it is proposed to map in this manner lies between latitude 37° 30′ and 38° and west of longitude 121° 30′. It thus includes San Francisco and its suburbs, the most thickly settled portion of the state.

The western half of this area will be mapped on a scale of 1:62500 on account of the density of the population. Prof. Lawson's work began only this spring, and has therefore as yet made but little progress. When completed it will form a very valuable and inexpensive addition to the geological map.

Yours respectfully,

G. F. Becker,
Geologist in Charge.

G. K. Gilbert,
Chief Geologist.

REPORT OF MR. C. D. WALCOTT.

Department of the Interior,
U. S. Geological Survey,
Division of Paleozoic Invertebrates,
Washington, D. C., July 1, 1892.

Sir: I have the honor to present the following report of the operations conducted under my charge for the year ended June 30, 1892:

FORCE.

The personnel of the division consisted of Mr. Ira Sayles and Mr. John W. Gentry, assistant paleontologists. Besides these Mr. Cooper Curtice, Mr. S. Ward Loper, Mr. William P. Rust, and Mr. F. W. Sardeson were employed as field collectors or as temporary laboratory assistants, and Prof. Henry S. Williams, of Cornell university, was, as heretofore, attached to the division in connection with special investigation of the Devonian and Carboniferous groups.

FIELD WORK.

The field operations for the year were carried on with special reference to their bearing on stratigraphic and areal geology. They were: (1) The study of certain horizons of the Middle Paleozoic in northern Arkansas and southern Missouri, eastern and central Kentucky, and central New York; (2) a study of the stratigraphy and extension of the faunas of the rocks in the vicinity of Granville, New York; (3) a study of the Lower Paleozoic rocks and the collecting of fossils in the vicinity of Crested Butte, Salida, and Canyon, Colorado; (4) a study of the stratigraphy and a collection of the faunas of the Lower Paleozoic rocks in southwestern Virginia, East Tennessee, and northern Alabama and Georgia; (5) the collecting of fossils from the Trenton formation of central New York and central Wisconsin; (6) a special study of the strata and faunas of the Cambrian rocks in the vicinity of Montevallo, Alabama, and Rome, Georgia.

The field work under the direction of Prof. Henry S. Williams was chiefly directed towards the accumulation of statistics and the elaboration of their details, for the determination of the length of the interval separating the Silurian and Carboniferous formations in the continental interior. In this connection Mr. Samuel Weller was employed during July and August in making collections and measuring sections in northern Arkansas and southern Missouri; and Prof. W. P. Jenney collected and sent to Prof. Williams material illustrating the paleontology of the western and the southwestern counties of Missouri. Mr. A. S. Eakle was employed to run sections across the same interval in eastern and central Kentucky. Mr. Ira Sayles made a large collection of Oriskany fossils in New York state, and Mr. Gilbert Van Ingen made a special collection of Oriskany fossils from Union Springs, New York under the direction of Prof. Williams.

In August I visited Trenton Falls, New York, to look after the work of Mr. William P. Rust, who was making collections from the Trenton limestones, and then proceeded to North Granville for the purpose of completing the mapping of the Cambrian strata in that vicinity. I joined Mr. Bailey Willis at the Natural Bridge, Virginia, September 5 and began the study of the Lower Paleozoic rocks of southwestern Virginia. This was carried across into Tennessee, and in October to northwestern Georgia and northeastern Alabama. Many points in the stratigraphy of the Lower Paleozoic were determined, and a large collection of fossils was made from measured sections for study in the laboratory. In May I proceeded to Canyon, Colorado, to complete the study and mapping of the Lower Paleozoic rocks exposed in Webster and Garden parks and northwest of Canyon. Thence I crossed to Turkey creek, southwest of Colorado Springs, to examine the Lower Paleozoic section in that vicinity, and from there went on to Glen Eyrie, near Manitou, and to Williams canyon, north of Manitou, to obtain data by which to correlate the sections there exposed with those about Canyon and in the interior of Colorado.

A detailed study was made of the sections and a large collection of fossils obtained by Mr. S. Ward Loper from the Lower Paleozoic rocks in the vicinity of Crested Butte, Salida, and Canyon, Colorado, during the period from August to November inclusive. Numerous sections were measured and twenty-eight boxes of fossils were shipped to Washington.

Mr. William P. Rust continued the systematic collection of fossils from the Trenton terrane in central New York until October 14, when he was taken ill while at work and died a few days thereafter. Mr. Rust was a skillful collector, and his work in New York, Vermont, and Massachusetts has given valuable results to the Survey during the past four years. The collections made by him contain thousands of fossils that have been and will be of service in the correlation of the standard sections of New York state with other sections in various parts of the country. Mr. F. W. Sardeson was employed for a few weeks in collecting Trenton fossils from typical sections in central Wisconsin, to be used in making correlations between that horizon in the Mississippi valley, New York, and Colorado.

OFFICE WORK.

As chief paleontologist I attended to the various administrative duties connected with the Paleontological Branch of the Survey. A monthly statement was made to each chief of division of the condition of his allotment. The monthly administrative reports were received, read, and such cooperation given to each division as was approved by the Director. The details of the work of the Paleontological Branch are given in the reports of the chiefs of the several divisions.

Prof. Henry S. Williams was engaged in the elaboration of the statistics collected by his assistants in the field for the determination of the length of the interval separating the Silurian and Carboniferous formations in the interior continental area. He also made a minute study of the evolution of characters in generic series as measures of geologic time. Considerable progress was made in this work, as also in the study and classification of the various collections made during the preceding year. The latter was done principally by Mr. Gilbert Van Ingen and Mr. Ira Sayles. A study was made of the fossils sent in by the geological surveys of Texas and Arkansas and a report made to the respective state geologists. A card catalogue has been made of the material obtained from various local sections, so far as elaborated, the genera and species being recorded on local fauna cards as far as determined. In connection with the Geological Survey exhibit at the World's Columbian Exposition a set of Devonian fossils was prepared for exhibition. also a partial set from the Carboniferous group. In addition to his various other duties Prof. Williams's assistant, Mr. Gilbert Van Ingen, carried on some special preparation and studies of paleontological series, representing variations. He also prepared tables of the distribution of fossils from the Oriskany sandstone. In addition to his field work Mr. Samuel Weller, a student at Cornell university, studied the crinoids of the Missouri collection, and identified and worked out with care most of the species and prepared lists of the same, to add to the faunal list being compiled by Prof. Williams.

The reading and correcting of the proof of the correlation essay on the Cambrian group, publisned as Bulletin 81 of the Survey, occupied most of my time during July. The latter part of August I took part in the meeting of the International Geological Congress in Washington. During the week of the meeting parties of foreign geologists and paleontologists were shown the collections of the Survey at the National Museum, and arrangements were made with some of them to exchange material in order to secure specimens from Europe to compare with those of similar geologic age in North America. A paper was also prepared and read by me on the Cambrian rocks of the North American continent.

After returning from field work in the southern Appalachians my attention was given to a systematic study of the Middle Cambrian fauna of Tennessee, Georgia and Alabama, for the purpose of obtaining data with which to correlate the various Cambrian rocks, now being mapped by the Appalachian Division of Geology. This work was continued during January and February, and verbal reports made from time to time to the geologists engaged in mapping the area under consideration. In connection with this work material was prepared that will be used in a monograph descriptive of the Middle Cambrian faunas and rocks of North America.

The routine work of the office and laboratory was attended to during the year, and a number of small collections were examined and reported upon to the geologists of the survey. These collections included material from California that was collected by Dr. Cooper Curtice, who was temporarily attached to Mr. George F. Becker's division, and those collected by Mr. J. S. Diller in northern California. A report was also made to Prof. Raphael Pumpelly upon fossils collected in the marble belt of Rutland county, Vermont, by a member of his division. In December a short report was made to Mr. Bailey Willis, of the Appalachian Division of Geology, upon certain Cambrian and Silurian fossils of the Southern Appalachians, and a similar report to Mr. Walter H. Weed on certain Carboniferous fossils from the Yellowstone National Park. In the preparation of the material for study in the various small collections sent in, and also of the collections from the southern Appalachians, I was assisted by Dr. Cooper Curtice, who was engaged in laboratory work during the three winter months.

The cataloguing and numbering of photographs taken during my field work of the past ten years were done in January, and the negatives in the photographic laboratory of the survey were each numbered to correspond to the list prepared. Heretofore the series taken each year were labeled and kept separately.

In connection with the Geological Survey exhibit at the World's Columbian Exposition work was begun upon the exhibit to be made by the Paleontological Branch of the Survey. The plan is to include a representation of the typical faunas of each geologic terrane (the term "terrane" being used in its broadest sense to include the larger divisions of the various groups—Devonian, Carboniferous, etc.), also an exhibit of some of the rocks of each terrane. As arranged in the Exhibition hall the fossils will occupy open table cases reaching along one side of the room for 100 or more feet, as the assignment of space may determine. Each terrane is to occupy a little more than a square yard of space for the fossils, and the rocks are to be exhibited in a shallow upright case, projecting about one foot above, and extending the entire distance of the table cases at their back margin. Immediately over the line of upright cases a diagrammatic geologic section will present a sketch of the rocks of each terrane from the Archean to the Quaternary inclusive. Over the terranes forming a group a map will show the geographic distribution of each such group on the North American continent as far as the data at hand will permit of its preparation.

In accordance with the preceding plan collections have been prepared from the Cambrian, Lower Silurian (Ordovician), Silurian, Devonian and Carboniferous rocks in charge of this division. The work on the Cambrian, Lower Silurian (Ordovician) and Silurian is practically complete, and it is well advanced on the Devonian and Carboniferous groups. In connection with this work Mr. S. Ward Loper was employed, under the authority of the World's Columbian Exposition, to prepare the material for exhibition and also to collect specimens from the upper portion of the Silurian and lower portion of the Devonian in the vicinity of Cumberland, Maryland. Mr. John Eyres, of LeRoy, New York, was also employed to obtain a series of fossil corals from the Lower Devonian of western New York. The systematic collections thus being prepared will be of permanent value to the Geological Survey as forming the nucleus of a collection that can be used as a standard of comparison in identifying and correlating fossils of the various rock series of the continent.

The work upon the Lower Mesozoic faunas was assigned to Prof. Alpheus Hyatt, the Upper Mesozoic or Cretaceous to Mr. C. A. White, and the Cenozoic to Mr. William H. Dall, the results upon which will be found in their yearly reports, respectively.

Mr. John W. Gentry remained in charge of the clerical work of the office during the year.

During the year two papers indicating the general studies of the division were published, namely:

Correlation Papers. Cambrian. Bulletin of the U. S. Geological Survey, No. 81, 1891, pp. 447, 3 plates (double), and 5 figures distributed through text.

Preliminary Notes on the Discovery of a Vertebrate Fauna in Silurian (Ordovician) Strata. Bull. Geol. Soc. of America, vol. 3, 1892, pp. 153–172, plates 3–5.

Respectfully submitted.

CHAS. D. WALCOTT,
Chief Paleontologist.

Hon. J. W. POWELL,
Director U. S. Geological Survey.

REPORT OF MR. C. A. WHITE.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
DIVISION OF MESOZOIC INVERTEBRATES.
Washington, D. C., June 30, 1892.

SIR: I have the honor to make the following report of the administrative work of this division for the fiscal year ending June 30, 1892.

FIELD WORK.

The field work which was begun by Mr. T. W. Stanton before the close of the last fiscal year was in progress at the beginning of this, he having continued his work from Colorado to Utah. On July 1 I left Washington for Salt Lake City, Utah, where I met Mr. Stanton on the 5th, and together we proceeded to examine the Upper Cretaceous formations of northern Utah and the adjacent parts of Wyoming. The special object of this work was to study the characteristics of the Colorado division of the Upper Cretaceous, and the stratigraphical position of the series of strata which had long been known as the Bear river Laramie. Our first work was done in the valley of Weber river, in the vicinity of Coalville, Utah, where a large part of the whole Upper Cretaceous series is found exposed, and where much important information was obtained concerning the limits of the different members of the series.

From the valley of Weber river we proceeded to that of Bear river, in southwestern Wyoming, where work was begun upon the Upper Cretaceous series, including the so-called Bear river Laramie. Other duties requiring my presence in Washington, I left Mr. Stanton to prosecute the field work alone and returned to the office of the Survey, arriving on the 17th.

Mr. Stanton continued the field work in the valley of Bear river and the adjacent districts, proceeding northward into portions of western Wyoming and southwestern Idaho. Returning he revisited Weber valley, and after completing the work there he returned to Washington, arriving on August 28.

With a view to gaining information that will be of service in my plan for making extensive collections of fossils from the Cretaceous formations of the southern states, I visited the cabinets of various colleges, universities, and state surveys in Tennessee, Mississippi, Alabama, Georgia, and Virginia, returning to Washington on the 30th. A journey for a similar purpose was undertaken by me to Boston and Newport, leaving Washington on May 3, and returning May 8.

Mr. Stanton, in company with Mr. T. E. Williard, spent October 28 and 29 in collecting fossils from Cretaceous strata in Prince George county, Maryland.

On May 4 Mr. Stanton left Washington for Utah, for the purpose of making field studies of the Upper Cretaceous, and he is now, at the end of this fiscal year, thus engaged.

OFFICE WORK.

Upon the completion in August of my review of the Cretaceous formations of North America, which has been published by the Survey as Bulletin 82, I began the preparation of manuscript of a work on the Laramie and related non-marine formations, including the discussion of subjects relating thereto. This work has occupied me during the greater portion of the year, and it is still in progress.

When not otherwise engaged, Mr. Stanton has continued work throughout the year on a review of the Colorado division of the Upper Cretaceous, and a revision of its invertebrate fossils. This work is now in an advanced state of preparation.

Mr. C. B. Boyle has continued work throughout the year upon the catalogue and bibliography of North American Mesozoic invertebrates, upon which he has long been engaged, and which is now completed, and the manuscript of which is submitted herewith. Mr. Boyle's connection with the Survey ceases by his resignation upon the completion of this work.

Mr. Williard was transferred to this division on October 1, since which date he has been engaged in the clerical work of the office and in aiding the work of preparing fossil collections for study and for installment in the National Museum.

As a partial result of the last season's field work, Mr. Stanton and myself each prepared an article on the Bear river formation, which was published in February of this year in the American Journal of Science, vol. 43, pp. 91–115.

During the year much office work was done on various collections of fossils, a large part of which belong to the Survey and were transferred to the U. S. National Museum on May 16. Others were collections which have been examined and reported upon at the request of various members of the Survey to aid them in their official work. Besides these, numerous collections have been examined and reported on for correspondents of both the Museum and Survey.

Respectfully submitted.

C. A. WHITE,
Geologist in Charge.

Hon. J. W. POWELL,
Director, U. S. Geological Survey.

REPORT OF MR. ALPHEUS HYATT.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
DIVISION OF LOWER MESOZOIC PALEONTOLOGY,
Cambridge, Massachusetts, June 30, 1892.

SIR: I have the honor to submit the following report of the operations conducted under my charge for the fiscal year ended June 30, 1892:

I left Cambridge, Massachusetts, July 2, 1891, and after visiting the museums at New Haven, Philadelphia, and Ithaca in search of types described by Prof. Gabb and the study of collections of Mesozoic fossils, I proceeded to Taylorville, California, to cooperate with Mr. Diller in the geological work in that region. We succeeded in adding one more horizon to those previously discovered in the Trias and another in the Jura, and gathered materials which were in larger part selected to fill out blanks in the collections previously made. In consequence of the greater length of time expended in the field, we were able to do this very effectually and sent home thirteen boxes of fossils.

Leaving Taylorville August 26, I went to San Francisco and inspected the collections of Mesozoic fossils at that place. Unfortunately the collections of the Natural History Society were not accessible, being stored in boxes, but I succeeded better at the Museum of the University of California and at the Mining Bureau, finding some valuable material, part of which I have since received as a loan for closer inspection.

After my return to Cambridge, September 9, work was resumed upon the collections in my laboratory and continued until the new accessions were received from Mr. Diller's division. These were unpacked and stored and then a careful revision of all of the fossils from that region, with some additional collections sent by Mr. Diller, was made. A report was sent to that gentleman for the use of his division. In cooperation with Mr. Diller I also prepared a preliminary account of the stratigraphical relations of these fossils and with your permission communicated the results to the Geological Society of America at the meeting held at Columbus, Ohio. A manuscript embodying these results was subsequently written and forwarded through the office of the Geological Survey to the publishing committee of the same society.

An important series of fossils collected by Mr. Becker's division in different parts of the gold belt from Colfax to Mariposa county, during the past three years, has been carefully examined, the species compared and described, and the results communicated to Mr. Becker for the use of his division. This work involved the revision and comparison of all the species published in this country and Canada from the Jurassic and Lower Cretacious rocks.

A collection intended for the Columbian Exposition to illustrate the Trias and Jura of the United States has been selected in accordance with directions received from the chief paleontologist. These were taken from the collections in my possession and those of the National Museum. All the finest specimens and many others which might prove essential to the work of this division could not be spared at the present time, and this collection, therefore, gives but a limited representation of the results of the work already accomplished. Nevertheless it is interesting and suggestive, and an expert will find in it information with regard to the relations of the faunas of the Trias and Jura of this country far in advance of all he could gather from published researches.

Respectfully submitted.

ALPHEUS HYATT,
Paleontologist in Charge.

Hon. J. W. POWELL,
Director U. S. Geological Survey.

REPORT OF MR. W. H. DALL.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
DIVISION OF CENOZOIC INVERTEBRATES,
Washington, D. C., June 30, 1892.

SIR: I have the honor to submit the following report of the operations conducted under my charge for the fiscal year ended this day.

FORCE.

The personnel of the division has comprised William H. Dall, paleontologist in charge; R. E. C. Stearns, paleontologist, and Gilbert D. Harris, assistant paleontologist; Frank Burns, skilled laborer.

During the first nine months of the year Mr. Stearns was absent on sick leave without pay. From September to March Mr. Gilbert D. Harris was absent on field work under the general supervision of the chief geologist. For the larger part of the year, therefore, the active force of the division has consisted of the writer and Mr. Burns. During April, May, and June Dr. Stearns has been engaged in field work in California. From September, 1891, to March, 1892, Mr. Harris cooperated with Dr. John C. Branner, state geologist of Arkansas, in the southeastern part of the state. The details of this work will be found in the administrative report of the chief geologist.

ROUTINE WORK.

The routine work of the division, as in previous years, has consisted largely of receiving, unpacking, cleaning, assorting, classifying, recording, naming, labeling, cataloguing, and arranging in order for easy reference the fossils of Cenozoic age and their later related forms. This material is collected by members of the Survey or presented by private individuals interested in geology. Another branch of the work consists in reporting on such specimens brought in by the geologists of the Survey desirous of learning the age of the strata from which they were obtained; or by private students of paleontology desirous of naming their fossils; or, lastly, by the directors of state surveys who desire to have the benefit of comparison with typical collections, such as may be found in the National Museum.

The labor of furnishing information on these and cognate subjects to inquirers from all parts of the country is constantly growing. In 1888–'89 the number of such applications was forty-five; in 1889–'90, sixty-nine; in 1890–'91, one hundred and sixty-six; and in 1891–'92, the year just closed, the number was two hundred and eight, from 114 different people.

Material referred to the division for determination by other members of the Survey has in all cases been promptly attended to. No arrears of this sort remain. No account has been kept of the number of species identified for members of the Survey, but for students and geologists in various parts of the country the number examined and indentified is about 3,370 in round numbers, against 1,800 during 1890–'91.

The accumulation of material from collections made in the field is increasing with great rapidity, many thousands of specimens having been obtained during the past season.

Much progress has been made in arranging for easy reference the named duplicates, and, on request, the division has prepared, labeled, and packed for use in the Survey exhibit at Chicago during the Columbian Fair, a series of 216 species of characteristic Tertiary fossils of the United States. Another series of 100 species has been prepared for the Congrés of August, 1892, at Moscow.

The registrations during the past year in the Museum catalogue have amounted to 2,546, equivalent to about 7,638 specimens. The entries of duplicates have numbered 1,708, the number of specimens in this case being much larger in ratio to the entry.

Miss N. C. Beard and Mr. S. H. Bond, of the Museum staff, have rendered occasional assistance by permission of the Museum authorities.

As facilitating the work of the division, the writer has continued, with the permission of the Director, to act as honorary curator of the Department of Mollusks of the U. S. National Museum.

FIELD WORK.

In November and December Mr. Burns was sent to Claiborne, Alabama, to obtain a collection from that classical locality, as several foreign paleontologists had expressed a willingness to exchange named fossils of the European Tertiary for unsorted Claiborne marl. Mr. Burns, though interfered with by bad weather and finally obliged to cease work on account of the advance of winter, met with fair success and forwarded 10 barrels of the marl.

Mr. Joseph Willcox, who has for some years been informally cooperating with the writer in the exploration of the southern Tertiaries, assisted by Mr. C. W. Johnson, of the Wagner Free Institute of Science, in Philadelphia, made some important explorations of the Tertiaries on the Waccamaw river, South Carolina, and near the mouth of the Neuse river, North Carolina. The fossils collected were sent with sections, etc., to the writer, and resulted in the establishment of the fact that well defined Pliocene beds occur in both states, and that the fauna illustrated by Tuomey and Holmes in their fine work on the Pliocene of South Carolina was heterogeneous and composed of species belonging to beds of different ages. On April 10 the writer, and on the 18th, Mr. Stearns, proceeded to California to carry on field work on the Tertiary beds of the Pacific coast. This work was carried on nearly to the end of the fiscal year with important results, showing confusion of faunas of different ages by early observers of the Pliocene and post-Pliocene beds in southern California. An outcrop of the Wallala beds of Dr. White at La Jolla, near San Diego, California, was carefully studied, and showed that these beds pass upward without break or unconformity into the Chico formation. Mr. Homer Hamlin and Mr. O. N. Sanford, of San Diego, have courteously cooperated in the exploration of these beds, and will continue to collect material until the species are sufficiently well represented to render practicable a study of the fauna by members of the Survey.

Mr. Burns went into the field at Calvert cliffs, Maryland, May 17, to obtain a representation of the fauna described from there by Conrad, and on June 4 continued similar work at Drumcliff, Maryland, returning to Washington on the 16th. On the 21st, and until the 30th, he was engaged on the Tertiaries of the lower part of the James river, near Yorktown, Virginia, with good results. Mr. Harris paid a short visit to the localities in Maryland for the purpose of reviewing the sections made by Conrad nearly half a century ago, in which serious errors were suspected, and on inspection were actually found to exist.

SPECIAL RESEARCHES.

The correlation essay on the Neocene of the United States, forming Bulletin 84 of the Survey, which was submitted in July, 1891, has passed through the printer's hands and is now nearly ready for publication. Part II of the writer's report on the Tertiary Mollusks of

Florida and the southeastern coast of the United States is in an advanced state of preparation, and the introduction, discussing the Pliocene beds of the Carolinas, was issued in advance by the Wagner Institute, of Philadelphia. A number of shorter papers bearing on the Tertiary fauna of the eastern United States and related forms have been published by the writer, Mr. Stearns, and Mr. Harris during the year.

MUSEUM EXHIBIT.

In the early part of the year, space being available in cases provided by the National Museum, a series of some three hundred characteristic Tertiary types of fossils of the United States was prepared, properly labeled, and put on exhibition so as to be ready for inspection at the time of the meeting of the International Geological Congress. The great mass of the Tertiary fossils not yet completely studied or determined, which has accumulated during the past few years, was wholly rearranged in geographical and stratigraphical order for ready reference, and a card catalogue was prepared to serve as index to the collection.

In conclusion the writer wishes to express his appreciation of the faithfulness and energy with which Messrs. Burns and Harris have devoted themselves to the work required of the division both in the Museum and in the field, a devotion which alone has made practicable the performance of so much as is briefly recorded in the foregoing abstract of the operations of the division for the year just closed.

Respectfully submitted.

Wm. H. Dall,
Paleontologist in Charge.

Hon. J. W. Powell,
Director U. S. Geological Survey.

REPORT OF MR. LESTER F. WARD.

Department of the Interior,
U. S. Geological Survey,
Division of Paleobotany,
Washington, D. C., June 30, 1892.

Sir: I have the honor to submit the following report of the operations of the Division of Paleobotany during the fiscal year:

FIELD WORK.

Mr. Charles S. Prosser was in the field from July 1 to August 26, engaged in studying the Middle and Upper Devonian formations of Monroe, Pike, and Wayne counties, Pennsylvania, with special reference to the flora and fauna. The collection made is of great importance in determining doubtful horizons and correcting previous errors.

Mr. David White was sent to Gay Head, Massachusetts, in July and again in September to examine the changes in the various sections formerly measured that have been produced by the agencies of frost, storms, and wave action in uncovering portions of the cliff and enabling him to obtain additional material.

In my last administrative report mention was made of the inauguration of a somewhat systematic investigation of the Potomac formation as a necessary preparation for writing that part of my essay on the geologic correlation of the plant-bearing deposits of the United States. As the city of Washington is located upon this formation it was possible to carry on this work by making short excursions. The region about Washington was carefully surveyed and highly successful expeditions made to the shores of Chesapeake bay, and the Severn and Patapsco rivers. Fossil plants were found in unexpected localities, some of them quite near the Capital, and these were of such a character as to throw an entirely new light upon the nature of the formation, suggesting the possibility of correlating it with others supposed to be of different age.

Local work of this nature was continued at convenient intervals until September 3, when a more extended expedition was undertaken. My chief desire in this was to accompany Mr. R. T. Hill to Texas and Arkansas, and examine the Trinity formation of those states with a view to the possible discovery of plant remains that should indicate the relation of that formation to the Potomac formation. But Mr. W. J. McGee was setting out at the same time with a party, consisting besides himself of Dr. E. W. Hilgard and Dr. Eugene Smith, to examine certain Tertiary deposits in the Mississippi valley, and was desirous that both Mr. Hill and myself should accompany his expedition. Fossil plants had been found by Mr. McGee in what was supposed to be the Lafayette formation, and he wished me to visit the localities and add my judgment as to their nature and probable age. At Grand Junction, Tennessee, we were joined by Prof. J. M. Safford, and later at Memphis by Prof. J. A. Holmes. After visiting typical deposits of the nature described at or near Grand Junction, La Grange, Memphis, Curve, and Randolph Bluffs, in Tennessee, and at Holly Springs, Lumpkins Mill, and Waterford, in Mississippi, we proceeded to Oxford, where I had the valuable privilege of examining the types of Prof. Lesquereux's early paper on the Tertiary Flora of Mississippi, which I had supposed to be lost. An inspection of these types in connection with the forms I had seen at the several localities previously named, convinced me that they all belonged to the same general series and were of substantially the same age, i. e., that the supposed Lafayette plants belonged to the La Grange formation, otherwise known as the Eolignitic or Mississippi Tertiary, commonly regarded as of Eocene age.

From Oxford the party proceeded to Natchez and thence down the Mississippi river in boats, stopping at various points, notably at Ellis's cliff and Fort Adams. At the former of these points a few fossil plants were found beneath heavy beds of Lafayette sand. This plant-bearing deposit is of special interest and deserves careful study, which time did not then permit. Although closely resembling the La Grange deposits of Tennessee and Mississippi farther north, and occupying the same relation to the Orange Sands (Lafayette), it was not believed by the geologists present to represent that series, but was thought to belong to the Grand Gulf formation of Hilgard, and the few vegetable fragments found were not decisive on this point.

New Orleans was reached on September 14, and San Antonio, Texas, on September 16, the party having now so far separated as to consist only of Messrs. McGee and Hill and myself. It was thought desirable to visit the Rio Grande at Laredo, where a peculiar fauna, perhaps Upper Cretaceous, was found at the base of the marine Lower Tertiary, and thence to penetrate some distance into Mexico to study the Mesozoic mountain system about Monterey, Saltillo, and to the east of Catorce and Vanegas.

Early in October Mr. Hill and myself commenced work in the Cretaceous of Texas and Arkansas, Mr. McGee having completed his work and returned to Washington. Proceeding first to southwestern Arkansas we met the Trinity formation along the Fort Towson road and followed it to the Little Missouri, where, at the so-called Plaster bluff, it is well developed, forming a gypsum cliff, at the base of which abundant lignites and some vegetable remains occur. We next went to Granbury, Texas, where an outfit was secured. Passing thence southward to Glen Rose over the belt of Paluxy sands, yielding silicified wood, we followed up the Paluxy river to Bluff Dale. In the bed of that stream, which flows over the Glen Rose division of the Trinity, 2 miles above the town of Glen Rose, there is a valuable plant-bearing deposit, made known to us by Mr. J. W. Harvey of that place. After spending a day at this locality we left Mr. Harvey with instructions to continue the work of collecting the fossil plants, and resumed the journey over the true Trinity sands, full of silicified wood, to Morgan's mill and beyond, reaching the margin of the Carboniferous some 7 miles west of the last-named place. On the 14th we had worked our way back to Bluff Dale, where Mr. Hill, unable to remain longer, left the party and returned to the East. I continued the work for five days longer, visiting important localities on Wolf creek, Paluxy river, etc., and then proceeding to Stephenville and down the Bosque river as far as Hico, in Hamilton county. From this point I crossed the mountainous tract to the north via Skipper's gap and Chalk mountain, reaching Glen Rose on the 18th and Granbury, by way of Comanche peak, on the 19th. I then returned to Washington by rail, arriving on the 23d.

During the months of November and December local field work in the Potomac formation was continued as opportunity would permit, and two large collections were made by Mr. White and myself, the one near the village of Brightseat, Maryland, 10 miles east of Washington, the other on the Fort Foote reservation, in bluffs of the Potomac river. These, with the equally ample collections made earlier on Pennsylvania avenue extended, east of the Anacostia river in the District of Columbia, at Grove point and Bodkin point on Chesapeake bay, and at Round bay on the Severn river, constitute an extensive flora from localities and at horizons in the Potomac formation from which no vegetable remains had previously been obtained.

On April 3 of the present year I left Washington for Tuscaloosa, Alabama, for the purpose of studying the Lower Cretaceous as it occurs in that state. While there I cooperated with Dr. Eugene A. Smith, state geologist of Alabama, who is specially interested in this formation. We visited all the known localities for fossil plants and discovered some important new ones. We made one excursion across the belt from Woodstock, where it appears only in the form of outliers and isolated patches of clay and sand resting on the Carboniferous, southward to its contact with the overlying marine Eutaw formation below Havana. We also made a collecting tour of five days' duration parallel to its general strike and near the only horizon at which plant remains have thus far been found, i. e., within a short distance of its landward (lower) margin. Some additional specimens were collected at Snow's, on the Black Warrior river, and at Cottondale, places which had previously yielded ample material to Prof. Fontaine. Besides these, two large collections were made from two practically new localities, viz, at Shirley's mill on Davis's creek, 11 miles south of Fayette courthouse, and at Glen Allen, on the Kansas City, Memphis and Birmingham railroad, 75 miles west of Birmingham. These two localities yielded an abundance of well preserved fossil plants. From this expedition I returned to Washington on April 20.

It had been my intention for some time to undertake in the spring a systematic field study of the Lower Cretaceous, from Virginia northeastward, paying special attention to stratigraphy and to the nature and order of deposition of the different members or subdivisions of the formation so far as these could be distinguished. Satisfied with the inadequacy of the method of study thus far adopted, viz, that of following the belt parallel with or at small angles to the strike, and convinced that the proper method was that of selecting suitable points, and making careful sections across the formation from its lower or landward to its upper or coastward side, I adopted this latter method, selecting for the first section the Rappahannock river, on which, at Fredericksburg, the largest collections of fossil plants had been obtained. In this work I have been assisted by Mr. David White, to whose active and intelligent cooperation a great measure of whatever success it may attain will be due. The Rappahannock section was carefully made and proved very important. A second section was then made in the vicinity of Aquia creek, which has also been a very productive region from the paleobotanical standpoint.

Preparations were then made for an overland expedition from the Potomac to the Raritan for the purpose of applying this method to as many points as seemed to promise good results. The party consisted, as before, of Mr. White and myself, and the principal mode of conveyance was a horse and buckboard, though it was not proposed to depend exclusively upon this, but to employ row or sail boats, rail or water transportation, or any other means available, necessary, or most economical of time or expense. Provided with maps, charts, and instruments requisite to such an enterprise, we left Washington on May 16, giving special attention to the Potomac formation in Maryland. The principal sections for which data were obtained in that state were those of the Patuxent, the Severn, the Patapsco, and the eastern shore of Chesapeake bay. We then made a study of the position of the belt through the state of Delaware, and traced it along the Schuylkill and Delaware rivers, connecting it with the clays of New Jersey. These latter were carefully studied, especially on the Delaware and Raritan rivers, with the object of correlating them with the Potomac formation in Virginia and Maryland. The Woodbridge district and Staten Island were embraced in the survey, and a visit was paid to some points on Long Island where the clays appear. The return trip was commenced on June 18, and was made a means of revisiting critical localities and of going to many new ones that had for one reason or another been omitted in passing through. The expedition was completed on June 27 by the return of the party to Washington.

In my administrative report for 1888–'89 reference was made to certain fossil plants from Bridgeton, New Jersey, which had been placed in the hands of Dr. John I. Northrop, of the School of Mines, Columbia College, New York, for determination. The absence of Dr. Northrop in the West Indies during the greater part of the following year, and his death soon after his return, left this investigation unfinished. But a considerable amount of additional material had been accumulated by him and others, and some progress had been made in studying and illustrating it. During the past year Dr. Arthur Hollick of the same institution applied to me for authorization to take up and continue this work, which was gladly given. Little was known of the geological position of the Bridgeton bed, and in June, while operating in New Jersey, a side journey by rail was made to that place at the time when Dr. Hollick was on the ground, for the purpose of endeavoring to determine the stratigraphical relations of the plant-bearing deposit. The result established its quite recent age relatively to the underlying strata, and Dr. Hollick remained to make further collections.

OFFICE WORK.

Except that Mr. T. E. Williard left the division at the end of September, the force has remained the same as at the close of the last fiscal year. It has, however, been deemed expedient on the part of the Division of Illustrations to have most of the work in that division done under the immediate supervision of the chief, and consequently Mr. von Dachenhausen has not regularly worked at the National Museum; but as the specimens of Potomac plants recently collected in the soft clays would not admit of being wrapped up or transported, he was permitted to spend a portion of each day there during a considerable part of the winter.

The changing character of the office work of the division makes it desirable to alter the classification slightly from that of previous reports. I shall therefore divide it primarily into original research and routine work, the latter of which may be subdivided as formerly.

Original research.—The increasing confidence of geologists in the diagnostic value of fossil plants has resulted in the frequent collection of this class of material and its reference to this division for determination and for a statement of its probable bearing on the question of the age of the deposits yielding it. To meet this demand it has been necessary for each of the members of the scientific corps to devote a large part of his time to this work. To Mr. David White, as previously reported, the Carboniferous system has been assigned, and he has entered vigorously upon the study of a large amount of material that has come into his hands, chiefly from Missouri, Arkansas, and Kansas. In connection with this work, and arising out of it, he has prepared a bulletin entitled "Flora of the Outlying Coal Basins of Southwestern Missouri," which is based on the personal study of a large number of specimens, and which seemed necessary as a preparation for the work in hand.

The demand for the determination of fossil plants from later formations has been even more urgent, and Mr. F. H. Knowlton has devoted most of his time during the year to this work. As formerly reported, I have also assigned to him the task of examining the lower forms from the Laramie formation, and he has labored under great difficulties from lack of European material with which to compare the specimens that have heretofore been identified with species from European deposits. He at length decided to make a voyage to Europe in order to visit the principal museums there in which these types are deposited. He accordingly crossed the Atlantic early in September and remained until near the end of October. He visited the National Museum at Copenhagen, Denmark, and examined the type specimens on exhibition there of most of the species described in Heer's Arctic Fossil Flora. At Stockholm he spent several days with Dr. Nathorst in going over the extensive collections of Cretaceous and Tertiary plants, also largely Arctic. In Berlin he was able to see many of Debey's types from the Upper Cretaceous of Aachen, and in London he obtained access to the rich Eocene flora of the London clays. He also ransacked the European herbariums for living plants with which these fossil floras have been compared, and brought back much valuable data to aid him in his work, which he has prosecuted since his return with greatly increased success.

Among the collections which have been determined and reported upon by Mr. Knowlton since his return from Europe should be mentioned one made by Mr. Cooper Curtice from the auriferous gravels of California; one sent by Mr. W. H. Weed from the Kootanie beds at Great Falls, Montana; a much larger one, also made by Mr. Weed, in the Bozeman coal mines of Montana, in reporting upon which he found it advantageous to include all the material thus far obtained from that general district, and the extensive collections made during several years past by Mr. Whitman Cross from the Denver formation. Besides these, numerous minor collections and isolated specimens from various localities have been examined and identified by him.

Mr. Charles S. Prosser, though devoting but a small part of his time to original research, has worked up his own Devonian collections and done much work of a stratigraphical character on the geology of northern Pennsylvania and western New York, publishing several important papers.

Mr. J. W. Harvey, of Glen Rose, Texas, who, as above stated, was employed to collect fossil plants from the deposit discovered by himself on the Paluxy River two miles above that place, shipped to the Survey seven boxes of the material obtained, which arrived early in the winter. The obvious resemblance of the plant remains to those from some of the localities in the Potomac formation of Virginia made it advisable to send the collection to Prof. Wm. M. Fontaine for determination. This was done and his report upon it has been received and will soon be published.

In the intervals between my several field campaigns above described I have occupied myself with the preparation of the data for that part of my correlation essay which is to treat of the Lower Cretaceous plant-bearing deposits. The large collections of new material which I made in the field required me to apply myself closely to their study and determination. The soft clay matrix in which these impressions are contained and the large blocks in which it was necessary to collect the greater part of the specimens involved great labor in working them out and exposing them for study. Most of my time not consumed in administrative duties during the winter months was given to this work. Early in March the large collection made by Prof. Wm. M. Fontaine, from the same formation, near Tuscaloosa, Alabama, two years ago, was sent me by him, and I spent that month in its study and in placing it in the condition in which I had placed my own collections. To this I was able to add a fine collection made some time ago by Mr. David White, at South Amboy, New Jersey, while his still more extensive collections from Gay Head, belonging to the same general series, required to be coordinated with the rest as together constituting the available material in hand from the Lower Cretaceous. I was, however, much embarrassed in this work by the need of Dr. J. S. Newberry's unpublished volume on the flora of the Amboy clays, the manuscript drawings of which I had several years ago seen. I also needed to examine and compare the specimens at Columbia College, New York, on which that work was based. I therefore made a brief visit to New York near the end of March for this latter purpose. Owing to the absence of Dr. Newberry I was unable to see his figures; but with the permission of Prof. J. F. Kemp, in charge, and the assistance of Dr. Arthur Hollick I was successful in making a thorough comparison of the Amboy clay specimens with sketches of my own types, which proved in a high degree instructive.

Being aware that Prof. P. R. Uhler, of Baltimore, had been actively at work on the Lower Cretaceous of Maryland for a number of years and had collected many fossil plants, I called upon him and was permitted to see such of these as had been unpacked, both at the Maryland Academy and at his house. Prof. Uhler has since placed in my hands for determination some of the more critical of these forms and has generously offered me the privilege of using any of his material in elucidating the difficulties that present themselves in the study of this remarkable flora.

It will be seen that, in consequence of the necessity for concentrating my efforts upon the Lower Crètaceous, work on the Laramie flora, already so far advanced, has been nearly suspended during the year. Not wholly so, however, as there have been intervals during which I have resumed my investigations in this field, and, as above stated, the greater part of Mr. Knowlton's work has borne directly upon this subject and will be incorporated in the final results.

Routine work.—Under this head naturally fall bibliographic work, catalogue work, and care of collections, as well as the regular correspondence and other office details not requiring special mention.

The bibliographic work has progressed slowly on account of the increasing other duties that have devolved upon Mr. White. During most of the time that he has been in Washington he has devoted several hours each day to it; much, however, remains to be done.

A far greater amount of time has been given to the catalogue work. A large amount of new literature has appeared during the year, and most of this has found its way to the division. The practice on the part of each member of the force of sending his own contributions freely and immediately to all who are known to be interested in the subject has produced the natural effect that all who are publishing in the same line respond promptly by sending their own papers, and these valuable works are treated by all as contributions to the library. There are also other ways in which the division comes into the possession of both new and old documents of value. All such accessions are catalogued as fast as they arrive, Miss L. M. Schmidt having charge of this branch of the work. In this manner the catalogue has grown very rapidly during the year, and in its present advanced stage its value increases at a much more rapid rate than its volume. Mr. Prosser, as appears from the above account of the field work of the division, has spent only six weeks in the field. The geological investigations which he has conducted at the office have been chiefly made out of office hours, so that he has really devoted nearly all his official time to the continuation of his revision and correction of the index slips as explained in my last two administrative reports. The estimate made in my last report that another year would be required to complete this part of the work has fallen short probably by about one month, the letter T having been completed at the end of June.

The two extensive collections made by Prof. Fontaine constituting the material for his two monographs (VI and XV) of the Geological Survey, and which had previously remained in his hands at the University of Virginia, were carefully labeled, packed, and boxed by him during the spring of 1891 and sent on to Washington at the close of the last fiscal year. They arrived at the National Museum on July 10, in forty-one boxes, twelve of which contained the specimens from the Trias or Older Mesozoic, and the remaining twenty-nine those of the Potomac or Younger Mesozoic. Mr. Williard at once commenced the work of unpacking and installing these collections, which occupied him until near the end of September, at which time his connection with the division ceased.

A noteworthy event of the year, though relating more immediately to the National Museum, still of the utmost importance to the Geological Survey and to science at large, has been the closing of an important transaction through which the great collection of Paleozoic plants of Mr. R. D. Lacoe, of Pittston, Pennsylvania, is to become the property of the United States and be placed in the National Museum, where, as honorary curator of the department of fossil plants, it will fall under my charge. The negotiations leading to this result were completed during the month of December, 1891, amounting to little less than a free gift on the part of Mr. Lacoe of this immense collection, the result of so many years industrious accumulation and great pecuniary outlay. Mr. Lacoe had, however, explained that the collection was not then in condition to be moved; that besides the types, which, as all know, Mr. Lacoe keeps in excellent order and accessible to all students, there was a large amount of duplicate material that required to be labeled, and in some cases compared and verified before he would be willing to let it be removed. I assured him that whenever he would indicate a suitable time I would send some one competent to do this work under his supervision. He informed me that he would have some leisure for this purpose in January and February, and accordingly on January 21 Mr. White went to Pittston to begin the work. He remained one month, when, in consequence of Mr. Lacoe's departure for a considerable period, the work was temporarily suspended. Much progress was made, however, and twenty-two boxes of fossil plants belonging to the Lacoe collection were shippped to Washington and have since been installed. The remainder will follow in due time.

Owing to severe illness Dr. J. S. Newberry has been unable to continue his personal investigations or make any report.

Prof. Wm. M. Fontaine submits the following report of work done by him during the year:

> During the last summer I was occupied, a portion of the time, in field work. This work was carried on in two portions of the state of Virginia, viz, in the eastern and southwestern. In the eastern part of the state certain openings had been made in attempting to develop coal seams. It was desirable to examine these to determine whether or not they contained fossil plants and to collect them if present. Some of the old fossil localities were reexamined and additional collections were made.
>
> In the southwestern part of the state, new localities were examined for the purpose of discovering and collecting fossil plants from the Pocono or lowest stage of the Carboniferous formation. Additional collections were made from old localities in this formation.
>
> During the year some work has been done in the preparation, study, and description of the Pocono plants. I have determined the character and probable age of certain older Mesozoic fossil plants, collected by Mr. Diller in California. I have determined two collections of fossil plants made from the Great Falls group of Montana, and prepared a paper describing them. I have also determined a collection of fossils plants made near Glen Rose, Texas, from the Trinity beds, and have prepared a paper describing them. The above constitutes my work up to date.

Very respectfully, your obedient servant,

LESTER F. WARD,
Geologist in Charge.

Hon. J. W. POWELL,
Director U. S. Geological Survey.

REPORT OF PROF. O. C. MARSH.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
DIVISION OF VERTEBRATE PALEONTOLOGY,
New Haven, Conn., July 1, 1892.

SIR: I have the honor to submit the following report of the work of this division during the past year:

In compliance with your letter of general instructions, I have continued the systematic work of collecting vertebrate fossils and investigating those of special interest to science. This work has gone on systematically and with success during the year.

The field work has been continued in the same region explored last year, especially with a view of obtaining accurate information in regard to the great Laramie formation, and its relation to the deposits above and below it along the eastern flank of the Rocky mountains. The questions connected with the Laramie itself increase in importance as the investigation is continued, and the necessity of systematic explorations throughout the whole extent of the formation is now demonstrated. The problems involved are of the greatest economic value, as the Laramie is the great coal-bearing formation of the West, but these problems are likewise so intimately associated with questions in geologic science that they can not well be separated.

The general results then attained in regard to the knowledge of the vertebrate life which existed during the deposition of the Laramie beds were given in my last annual report, and the researches of the past year have added largely to the material secured, and made clear many points hitherto involved in doubt. The investigation is still incomplete, but enough is now known to prove conclusively that the fauna of one horizon, the Ceratops beds, is among the most remarkable yet discovered in any part of the world. This remarkable fauna is of Cretaceous age, as the hundreds of specimens now known demonstrate beyond reasonable doubt. All its main associations are with the Mesozoic below and not with the Tertiary above. Between this horizon and the known base of the Eocene is a great faunal break, and it is in this part of the geologic section that earnest and systematic work is now specially needed, and here, too, most important results from such work may be expected.

The development of the Tertiary formation in the Rocky mountain region has no known parallel in any other part of the world. During the whole of this period an extensive series of fresh-water lakes succeeded each other throughout Eocene, Miocene, and Pliocene time. Vertebrate life was everywhere abundant, and each lake basin thus preserved a rich record in its slowly accumulated deposits. This record, as yet only partially disclosed in each of the three divisions of the Tertiary, clearly indicates the life history of many groups of mammals, and marks out with considerable certainty the genealogy of the principal types existing to-day. In the lowest deposits of the Eocene lake basins the remains of mammals are so abundant and varied as to clearly demonstrate that this form of animal life was dominant. The contrast between this fauna of the great mammalian age and the remarkable reptilian fauna of the Laramie below is profound, and the true meaning and explanation of this break has been one object kept constantly in view in the investigations of this division during the past year.

One feature of the work of this division in the East during the early part of the year was completing the preparation of the large collection of vertebrate fossils selected for the National Museum, and sending them to Washington to be placed on exhibition before the meeting of the International Geological Congress. The collection weighed nearly three tons and a half, and was more than sufficient to fill the large case specially prepared for it in the National Museum. Among the specimens sent were three skulls of the gigantic Triceratops, from the Laramie of Wyoming; ten skulls of Brontotheridæ, from the Miocene of Nebraska and Dakota, and numerous other remains of the same group from the same general localities; a large collection of extinct Rhinoceroses, from the Pliocene of Kansas, and other important vertebrate fossils from the West, the whole making a collection of great value and scientific interest. Other important collections are now in preparation, and will be sent to the National Museum when cases are provided for them.

The work on the monographs in preparation has been continued systematically during the past year, but not so rapidly as I had hoped, owing to new discoveries of importance. The following articles on vertebrate paleontology have also been prepared by me, and published during the year:

Note on Mesozoic Mammalia. Proc. Am. Acad. Nat. Sci. Phila. With plate.

Proc. Acad. Nat. Sci., Philadelphia, 1891, pp. 237–241. Restoration of Stegosaurus. With plate.

Amer. Jour. of Science, vol. XLII, pp. 179–181, August, 1891. Notice of New Vertebrate Fossils.

Amer. Jour. of Science, vol. XLII, pp. 265–269, September, 1891. Geological Horizons as determined by Vertebrate Fossils. With plate.

Amer. Jour. of Science, vol. XLII, pp. 336–338, October, 1891. The Skull of Torosaurus. With two plates.

Amer. Jour. of Science, vol. XLIII, pp. 81–84, January, 1892. Discovery of Cretaceous Mammalia. Part III. With seven plates.

Amer. Jour. of Science, vol. XLIII, pp. 249–262, March, 1892. Recent Polydactyle Horses.

Amer. Jour. of Science, vol. XLIII, pp. 339–355, April, 1892. A New Order of Extinct Eocene Mammals (*Mesodactyla*).

Amer. Jour. of Science, vol. XLIII, pp. 445–449, May, 1892. Notice of New Reptiles from the Laramie Formation.

Amer. Jour. of Science, vol. XLIII, pp, 449–453, May, 1892. Notes on Triassic Dinosauria. With three plates.

Amer. Jour. of Science, vol. XLIII, pp. 543–546, June, 1892. Notes on Dinosauria,

Very respectfully,

O. C. MARSH,
Paleontologist in Charge.

Hon. J. W. POWELL,
Director U. S. Geological Survey.

REPORT OF PROF. S. H. SCUDDER.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
DIVISION OF FOSSIL INSECTS,
Cambridge, Mass., June 30, 1892.

SIR: I have the honor to submit the following report of the operations conducted under my charge for the fiscal year ended June 30, 1892:

SIR:

The monograph of the Tertiary rhynchophorous Coleoptera of the United States, referred to in my last report, monopolized the work of the Division of Fossil Insects during the first half of the past official year. The manuscript of the same, with material for twelve quarto plates, was forwarded on the last day of 1891. It includes nearly two hundred species, most of them new, and shows that our Tertiary fauna is considerably richer than the European, comparisons with which are instituted throughout. Some of the general results reached in the study of these insects have been published in a paper in the Proceedings of the Boston Society of Natural History, which is the only publication of the past year, excepting the index to the known fossil insects of the world (Bulletin 71) referred to in my last report as then ready to be issued.

Other descriptive work of the year has been (1) a selection of miscellaneous forms of special interest from our western Tertiaries, which was forwarded in July, 1891, for publication as a bulletin with three plates (Bulletin 93); (2) a report on the insects of the Rhode Island coal field with two plates, forwarded the last of March, also for publication as a bulletin (Bulletin 101); (3) a review of the Tertiary aphidæ of North America, with five plates, submitted the last of March for publication in the Thirteenth Annual Report of the Survey; (4) description of a new genus and species of Elateridæ from Fossil, Wyoming, from borrowed material; and (5) a revision of the American fossil cockroaches, with descriptions and figures of a large number of new forms, a work which is still in progress.

During the year the work of attaching to the specimens in my care the distinctive labels of the Survey has been completed, as well as the separate numbering and cataloguing of the same, so that every specimen belonging to the Survey can now be quickly identified; a copy of the catalogue has been forwarded to the office of the Survey in Washington.

For the use of the division and to accompany the card catalogue of the described fossil insects of each separate Tertiary locality in America, mentioned in my last report, a similar catalogue for each distinct European Tertiary locality has been begun (based on my index to fossil insects, Bulletin 71), and nearly completed. At the same time Bulletin 71 has itself been kept up to date by a supplementary card catalogue prepared upon the same lines.

A sample collection of fossil insects from the American Tertiaries, including about one hundred and sixty species named and carefully selected to present as varied an assortment as possible, was forwarded in July last to Washington for exhibition during the meeting of the International Geological Congress.

During the latter half of May a visit was paid to the localities at Cassville, Monongalia county, West Virginia, and Wills creek, near Steubenville, Jefferson county, Ohio, where in Permian and Carboniferous strata remains of insects have been found in some number, to personally examine the localities with a view to further work in them. A few specimens were found even in the short time that could be devoted to search, one, at Wills creek, proving to be of particular interest. This was the only field work of the year.

Progress has been made in the preparation of drawings for the use of the division. Most of the artist's work has been upon the Tertiary weevils and Carboniferous cockroaches. In all one hundred and seven enlarged drawings in ink have been completed, ready for photographic reproduction when needed. A considerable part of them, indeed, have already been forwarded in connection with the memoirs completed during the year. Besides these, corrections have been made in twenty earlier drawings of other species, previous to their use in publications.

Respectfully submitted.

SAM'L H. SCUDDER,
Paleontologist in charge.

Hon. J. W. POWELL,
Director U. S. Geological Survey.

REPORT OF MR. F. W. CLARKE.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
DIVISION OF CHEMISTRY,
Washington, D. C., June 30, 1892.

SIR: During the fiscal year 1891-'92 the work of the Division of Chemistry and Physics has varied little from its usual lines. My own time, however, has been largely occupied by outside duties, relative to the preparation of the Survey exhibit for the World's Columbian Exposition at Chicago. In that connection I have made several collecting trips, and I have also sent agents into the field in search of material. Mr. Melville and Mr. R. L. Packard went to Montana and Idaho, and Prof. S. L. Penfield, of New Haven, spent his summer vacation of 1891 in Colorado, working in our behalf. Much material has been brought together, and our display promises to be good, especially as regards the finer minerals.

In the laboratory I have continued my researches upon silicate structure, ably assisted by Mr. E. A. Schneider. The chlorite group has been exhaustively discussed on the theoretical side, and experimental evidence was obtained in support of our conclusions. The work is being actively continued, and is to be soon extended to the important group of the zeolites. The main working hypothesis that the complex natural silicates are substitution derivatives of normal salts is being amply confirmed.

In other directions the work of the laboratory has been more than ordinarily varied. Apart from the purely routine analyses, called for in the current work of the Survey, the following investigations are worthy of special notice:

By Mr. W. F. Hillebrand, analyses of two spring waters from Newton county, Missouri, which are unique in carrying large amounts of sulphate of zinc in solution. Mr. Hillebrand has also analyzed a remarkable mineral water from Ojo Caliente, near Taos, New Mexico; and has investigated the composition of two rare minerals from Llano county, Texas. One was the new species Rowlandite, the other a variety of Uranothorite. He has now the remarkable fluorides from Pikes peak under examination, and one new species seems to have already been detected.

Early in the year we received from Mr. W. H. Hampton, of Portland, Oregon, a number of black pebbles which were highly magnetic. They were found in gravels occurring in Jackson and Josephine counties, Oregon, and proved to consist mainly of a metallic alloy of nickel and iron, with about 13 per cent of stony admixture. They were exhaustively analyzed by Mr. W. H. Melville, and were found to contain nearly 62 per cent of nickel, being akin in composition to the awaruite of New Zealand, and the metallic scales described by Sella from a river gravel in Italy. Although resembling small meteorites in general character the pebbles are undoubtedly terrestrial in origin, and it is most desirable that the rock which yielded them should be found in situ. Their scientific interest is very great, and they have a probable economic interest also.

Mr. T. M. Chatard has been engaged during the year on the investigation of the phosphate deposits of Florida. In addition to numerous analyses of typical samples of the various occurrences, he has made comparative studies of analytical methods, particularly those for the determination of the oxides of iron and aluminum. The accuracy of the determination of these constituents is most important for commercial valuation as shown by the large number of communications on this subject which have lately appeared in the chemical journals. These analytical results will be published before long, to be followed as soon as practicable by the main geologico-chemical paper on the nature and origin of the Florida phosphates.

Mr. L. G. Eakins reported upon a new meteoric iron from Adams county, Pennsylvania, and also finished the examination of an interesting group of minerals, garnet, idocrase, epidote, etc., from Italian mountain, Colorado. Mr. H. N. Stokes continued his researches upon the silicic ethers, and, incidentally, discovered a new amido-phosphoric acid, which will soon be described. Mr. Schneider, in addition to the work on the silicates already mentioned, extended somewhat his observations upon colloids, especially upon colloidal silver. In April, 1892, Mr. George Steiger was added to the laboratory force, and since then he has been occupied with routine work, such as assays, coal analyses, etc.

The routine of the laboratory has followed the usual lines. In all, 321 analyses were reported during the year, exclusive of Mr. Chatard's work on the phosphates. Among rock analyses, 22 were reported for the educational series, 16 from Massachusetts, 4 from Vermont, 8 from

Maryland, 10 from Minnesota, 5 from Montana, and 10 from the Yellowstone park. Two analyses of xenotime from North Carolina and two of beauxite from Jacksonville, Alabama, are also worth noting, and a large series of measurements of the amount of sediment in Potomac river water deserves mention.

On the physical side the work, as heretofore, has been carried forward by Mr. Carl Barus and Mr. William Hallock. With the object of ascertaining the effect produced on the distribution of temperature in the earth by sandwiching liquid strata between solid strata, Mr. Barus spent much time in studying the change of heat conductivity which accompanies the passage of a body from the solid to the liquid state. The research is necessarily complex, since it premises a full knowledge of the thermal expansions of the solid and the liquid, as well as of the specific heats for the two states, throughout the given interval of temperature. The results obtained, in addition to their geological bearing, throw some light on the laws of molecular force. In another series of researches Mr. Barus endeavored to assign values to the fusion constants of igneous rocks, the chief datum in view being the effect of pressure on the melting point. Measurements of the thermal expansion of basic rock magmas passing from solid to liquid, and of the thermal capacities of the same magmas under like conditions, were made with great detail. From these results the important relation specified has been computed. The research leads to new facts relative to the state of fusion along the first tenth of the earth's radius. A bulletin covering the whole of the work done is in the hands of the Public Printer.

Finally, Mr. Barus has studied the effect of temperature and pressure on viscosity, with the object of ascertaining what changes of these two variables (pressure and temperature) will be without effect on the physical state of the body. The research leads to important results relative to the conditions of equal fluidity of rock magmas.

Regarding physical work at present in progress, the question of the effect of water in promoting rock fusion has been actively attacked, but the experiments thus far have all ended in explosions. On the other hand the attempt to represent the character of rock fusion by measuring the electric conductivity of molten magmas has already led to results of definite lithological value.

On November 15 Mr. Hallock resigned from the Survey to accept a position elsewhere. Up to that date he was occupied as follows: During the month of July the temperature observations in the Wheeling, West Virginia, deep well were continued and the present series completed. In August the results were reduced and a preliminary report made. During the month of September the temperature apparatus was transferred to Crumps Bottom, West Virginia, for work in a well there 3,000 feet deep. It proved full of water, and only a few measurements were taken under the unfavorable conditions. October and part of November were consumed in analyses of the air samples taken at Wheeling and in routine laboratory work.

Very respectfully,

F. W. CLARKE,
Chief Chemist.

Hon. J. W. POWELL,
Director U. S. Geological Survey.

REPORT OF MR. DAVID T. DAY.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
DIVISION OF MINING STATISTICS AND TECHNOLOGY,
Washington, D. C., June 30, 1892.

SIR: I have the honor to report that during the fiscal year ending this day the work of the Division of Mining Statistics and Technology has consisted in the completion, editing, and proof-reading of the report "Mineral Resources of the United States, 1889 and 1890," which is now being printed and will be issued about August 1.

The work on which I was detailed—to prepare the final report on the "Mineral Industries in the United States" for the Eleventh Census—was also completed. The volume was submitted to the Superintendent of Census at the beginning of the last fiscal year, and during the year proof was revised and the work stereotyped. It also will appear in the course of a few weeks.

In addition to this, and the usual technical correspondence and replies to an unusually large number of requests for statistical information, the preparation of the volume "Mineral Resources of the United States, 1891," has been pushed forward towards completion.[1]

The personnel of this division consisted of Messrs. Edward W. Parker, Jefferson Middleton, and William A. Raborg in addition to myself, and to the efficient work of these gentlemen the preparation and publication of both the Census volume and that for the Survey is due.

Very respectfully, your obedient servant,

DAVID T. DAY,
Geologist in Charge.

Hon. J. W. POWELL,
Director U. S. Geological Survey.

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[1] For some of the results attained, see the Director's Report.

REPORT OF MR. F. H. NEWELL.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
DIVISION OF HYDROGRAPHY,
Washington, D. C., June 30, 1892.

SIR: I have the honor to submit the following report of the Division of Hydrography for the fiscal year ending this day.

The principal work of the past year has been the compilation of data regarding the discharge of various rivers of the West and the preparation for publication of this material, together with general descriptions and a study and discussion of the subject of water supply. The results are for the most part shown in the paper entitled "Water supply of the arid region," prepared for insertion in Part 2, Irrigation, of this report. This paper forms the fourth of the series relating to the hydrography of the arid region and follows the same plan as those preceding. In the report for the year immediately before this there are, besides the presentation of the hydrographic data, detailed descriptions of the drainage basins of the Rio Grande and Gila. In the present report are similar descriptions of the Missouri basin in Montana, the Yellowstone basin, and the Platte basin above the junction of the North and South Platte. There still remain undigested materials for a general discussion of the water supply in each of the other large catchment areas within the arid region.

Much of the work for this report has been done by Mr. Cyrus C. Babb, who, in addition, has made experimental tests of the efficiency of various forms of gauging apparatus, in the course of which he has obtained data relative to the discharge of the Potomac. This material has proved of value not only as bearing upon the hydrography of rivers of humid regions, but also for drawing comparisons between the behavior of streams of different parts of the country. My own time has been largely occupied by the work of the Census Office in the preparation of reports upon irrigation in various states and territories. For this purpose leave of absence of one hundred and eighty-seven days was obtained. The free employment of information obtained by this office and by the census has been of advantage in preparing publications for both bureaus, from the fact that one class of material supplemented the other.

I have the honor to be, your obedient servant,

F. H. NEWELL,
Topographer in Charge.

Hon. J. W. POWELL,
Director U. S. Geological Survey.

REPORT OF MR. D. W. GILL.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
DIVISION OF ILLUSTRATIONS,
Washington, D. C., June 30, 1892.

SIR: During the fiscal year ending to-day, the personnel of the division has remained about the same as last year, the following draftsmen having been steadily employed: John L. Ridgway, Daniel W. Cronin, H. Hobart Nichols, H. A. C. Hunter, F. W. von Dachenhausen, Daniel P. O'Hare, Henry S. Selden, Malcolm A. Cudlipp, and Wells M. Sawyer.

William A. Wansleben was employed temporarily from January 27 to May 21, in completing certain maps and geologic sections to accompany the report of Mr. Bailey Willis.

Mr. Ridgway continues as my assistant in the management of the division. He was engaged the past year in preparing miscellaneous geologic and paleontologic drawings and has rendered faithful and efficient service in the supervision of drafting and the routine office work.

Messrs. Cronin, Hunter, Selden, and Cudlipp, were employed in the preparation of maps, diagrams, and sections. Mr. Nichols's work has been the preparation of geologic landscapes and the retouching of photographs. Mr. O'Hare has been engaged on a map of the Appalachian region and in proof-reading engraved work. Mr. von Dachenhausen has been engaged almost exclusively in drawing paleobotanic specimens for Mr. Lester F. Ward. Mr. Sawyer has been engaged in the preparation of miscellaneous geologic drawings and the retouching of photographs.

Drawings to the number of 1,619 were produced in this division during the year, and, as many of them are elaborate maps, each requiring many weeks' labor, the showing is quite satisfactory when compared with the previous year's work, when 1,520 were produced. The drawings are classified as follows:

Paleontologic	667
Geologic and topographic sections and diagrams	310
Geologic landscapes	42
Maps	31
Miscellaneous	569

The illustrations for twelve bulletins and three monographs were transmitted to the Public Printer during the year. The illustrations for these publications were classified for engraving as follows:

Chromo-lithography	43
Wood engraving	23
Half tone	42
Photo-engraving	198

I have on hand 242 completed drawings, being the illustrations for this your Thirtieth Annual Report.

Engraved proofs of 1,070 drawings have been received from the Public Printer during the year. The criticism and revision of this material has been carried on as in previous years, and the highly satisfactory methods of the Government Printing Office enables us to make reasonably prompt returns to the contracting engravers.

Complete records have been kept of all drawings and proofs transmitted to and from the Government Printing Office.

The printed editions of all chromo-lithographs used in the publications of the Survey during the year have been examined by me and the imperfect work rejected.

No field work has been undertaken by me or my assistants during the year.

The photographic laboratory has been conducted as in previous years under the able supervision of Mr. J. K. Hillers, assisted by C. C. Jones, assistant photographer, and John Erbach, Charles A. Ross, and Edward Block, photographic printers.

Although the facilities have not been increased a thorough system of work enables Mr. Hillers to show a large increase in the output of the laboratory over last year. The following is a statement for the year ending to-day.

Negatives.		Prints.	
Size.	Number.	Size.	Number.
28 by 34	246	28 by 34	1,571
22 by 28	51	22 by 28	333
20 by 24	488	20 by 24	3,307
14 by 17	55	14 by 17	312
11 by 14	602	11 by 14	2,030
8 by 10	195	8 by 10	2,824
		5 by 8	1,633
		4 by 5	1,838

Very respectfully, your obedient servant,

DELANCEY W. GILL,
In charge.

HON. J. W. POWELL,
Director U. S. Geological Survey.

REPORT OF MR. S. J. KÜBEL.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
DIVISION OF ENGRAVING AND PRINTING,
Washington, D. C., June 30, 1892.

SIR: During the fiscal year ending to-day the Division of Engraving and Printing has steadily grown in size, in plant, and in amount of work done. The work of the division consists in the engraving, printing and mounting of maps, and to a greater or less extent in a study of and experimentation with processes for more rapidly and cheaply performing such work. The division was organized in February, 1890, with a force of 6 men. The demands made upon it were from the start large, and have steadily increased. To meet these demands the number of engravers and assistants and the amount of machinery have been gradually increased. At the close of last year the number of employees was 12; at the close of the present year the number is 23. In machinery there was added during the year a No. 2 Hoe lithographic power press, a stone-planing machine, a standing press, and 2 new lithographic hand presses, all being necessary for rapid and economical work.

The work of the division falls naturally into three classes: (1) engraving; (2) printing, with the allied branches of transferring, making offsets, etc.; (3) map mounting.

ENGRAVING.

The engraving of the topographic atlas sheets and maps made by the Survey is done upon copper plates. It is done in part in this division and in part by private parties, who perform the work by contract. During last year 15 per cent of the engraving was done in this division and the remaining 85 per cent by contract. During the present year 30 per cent was done in this division and the remaining 70 per cent by contract. All the miscellaneous and experimental engraving and all correcting and revising of plates is done in this division, as well as a part of the new work. Contracts have been let for new work only. It is estimated that three-fourths of the time of the engraving force is given to other than new work.

Of new work engraved in this division during the year may be mentioned—

(1) Contour map of the United States, scale 1:7,000,000, or about 110 miles to an inch.

(2) Base map of the United States, scale 1:14,000,000, or about 221 miles to an inch.

(3) Contour map of the Arkansas drainage basin, scale 1:380,160, or 6 miles to an inch.

(4) One sheet of the Appalachian mountain system, scale 1:380,160, or 6 miles to an inch.

The editions of certain of the atlas sheets are rapidly exhausted owing to special demands, and before new editions are printed the plates are revised, corrected, and brought to date. This revision work consumes the major part of the time of the engraving force.

PRINTING OF MAPS.

During the year there were printed 131,000 copies of copies of atlas sheets in three colors; 5,000 copies of base map of the United States, scale 1:7,000,000, in four colors; 4,000 copies of hypsometric map of the United States, scale 1:7,000,000, in two colors, together with a considerable amount of miscellaneous printing, chiefly of different assemblages of colors and patterns for use in delineating geologic formations.

Also, in the case of several important regions, notably of New York city, several whole or partial sheets have been combined and editions of the united map printed.

There was also prepared and printed an "index map" of the United States, in nine sheets, showing the positions and names of the various atlas sheets surveyed, engraved and printed. This gives the name, boundary, and scale of every atlas sheet. Small editions are printed from time to time, the original being preserved on zinc plates, to which additions are easily and quickly made as the work progresses.

The maps are printed, in general, from lithographic stones, to which a fac-simile of the engraving on the copper has been "transferred." For certain work, notably in printing geologic patterns and the body colors of the hypsometric map, the transfers are made to zinc plates. This introduction of the use of zinc plates, made during the present year, has been wholly successful. A high grade of work has been maintained and at diminished cost. It is especially economical in the case of work which is to be used again in future printings, as the plates are cheap and occupy small storage space.

Map-mounting.—The mounting of maps on cloth for preservation and for assembling the parts of maps too large for a single printing was transferred to this division during the year, and has given steady employment to one and part of the time to two men.

A complete and accurate record or system of accounts has been instituted and steadily maintained, showing the cost of each piece of work done in the division.

During the past year the rate of production of engraved atlas sheets has increased rapidly over former years. One hundred and forty-two sets of plates, representing a like number of completed atlas sheets, were added to the stock of plates in possession of the Survey. The entire lot of engraved topographic atlas sheets now on hand, representing a cost value of $185,000, numbers 615. To this must be added the engraving of special maps. The care, preservation, and handling of these plates is in charge of this division.

Atlas sheets engraved to June 30, 1892.

Locality.	Name of sheet.	Designation of sheet.				Area covered.	Scale.	Contour interval.
		Lat.		Long.				
		°	'	°	'			*Feet.*
Maine	**Portland**	43	30	70	15	1/16 degree	1 : 62500	20
	Newfield	43	30	70	45	....do ...	....do	20
	Biddeford	43	15	70	15	....do ...	....do	20
	Kennebunk	43	15	70	30	....do ...	....do	20
	Gardiner	44	00	69	45	....do ...	....do	20
	Freeport	43	45	70	00	....do ...	....do	20
	Augusta	44	15	69	45	....do ...	....do	20
	Buxton	43	30	70	30	....do ...	....do	20
	Waterville	44	30	69	30	....do ...	....do	20
Maine and New Hampshire.	**York**	43	00	70	30	....do ...	....do	20
	Dover	43	00	70	45	....do ...	....do	20
	Berwick	43	15	70	45	....do ...	....do	20
New Hampshire and Vermont.	**Brattleboro**	42	45	72	30	....do ..	....do	20
Vermont	**Wilmington**	42	45	72	45	....do ...	....do	20
Massachusetts and New Hampshire.	**Newburyport**	42	45	70	45	....do ...	....do	20
	Haverhill	42	45	71	00	....do ...	....do	20
	Lawrence	42	30	71	00	....do ...	....do	20
	Lowell	42	30	71	15	....do ...	....do	20
	Groton	42	30	71	30	....do ...	....do	20
	Fitchburg	42	30	71	45	....do ...	....do	20
	Winchendon	42	00	72	00	....do ...	....do	20
Massachusetts, New Hampshire, and Vermont.	**Warwick**	42	30	72	15	....do ...	....do	20
Massachusetts and Vermont.	**Greenfield**	42	30	72	30	....do ...	....do	20
	Hawley	42	30	72	45	....do ...	....do	20
	Greylock	42	30	73	00	....do ...	....do	40
Massachusetts, Vermont, and New York.	**Berlin**	42	30	73	15	....do ...	....do	20
Massachusetts and New York.	**Pittsfield**	42	15	73	15	....do ...	....do	20
Massachusetts	**Gloucester**	42	30	70	30	....do ...	....do	20
	Salem	42	30	70	45	....do ...	....do	20
	Boston Bay	42	15	70	45	....do ...	....do	20
	Boston	42	15	71	00	....do ...	....do	20
	Framingham	42	15	71	15	....do ...	....do	20
	Marlboro	42	15	71	30	....do ...	....do	20
	Worcester	42	15	71	45	....do ...	....do	20
	Barre	42	15	72	00	....do ...	....do	20
	Belchertown	42	15	72	15	....do ...	....do	20
	Northampton	42	15	72	30	....do ...	....do	20
	Chesterfield	42	15	72	45	....do ...	....do	20
	Becket	42	15	73	00	....do ...	....do	20
	Provincetown	42	00	70	00	....do ...	....do	20
	Duxbury	42	00	70	30	....do ...	....do	20
	Abington	42	00	70	45	....do ...	....do	20
	Dedham	42	00	71	00	....do ...	....do	20
	Wellfleet	41	45	69	55	....do ...	....do	20
	Plymouth	41	45	70	30	....do ...	....do	20
	Middleboro	41	45	70	45	....do ...	....do	20
	Taunton	41	45	71	00	....do ...	....do	20

Atlas sheets engraved to June 30, 1892—Continued.

Locality.	Name of sheet.	Designation of sheet.		Area covered.	Scale.	Contour interval.
		Lat.	Long.			
		° ′	° ′			*Feet.*
Massachusetts	Chatham	41 30	69 45	$\frac{1}{16}$ degree	1:62500	20
	Yarmouth	41 30	70 00	....do ...	....do	20
	Barnstable	41 32	70 15	....do ...	....do	20
	Falmouth	41 30	70 30	....do ...	....do	20
	New Bedford	41 30	70 45	....do ...	....do	20
	Nantucket	41 13	69 57	....do ...	....do	20
	Muskeget	41 15	70 12	....do ...	....do	20
	Marthas Vineyard	41 15	70 72	....do ...	....do	20
	Gay Head	41 15	70 42	....do ...	....do	20
Massachusetts and Connecticut.	Webster	42 00	71 45	....do ...	....do	20
	Brookfield	42 00	72 00	....do ...	....do	20
	Palmer	42 00	72 15	....do ...	....do	20
	Springfield	42 00	72 30	....do ...	....do	20
	Granville	42 00	72 45	....do ...	....do	20
	Sandisfield	42 00	73 00	....do ...	....do	20
Massachusetts, Connecticut, and New York.	Sheffield	42 00	73 15	....do ...	....do	20
Massachusetts and Rhode Island.	Franklin	42 00	71 15	....do ...	....do	20
	Blackstone	42 00	71 30	....do ...	....do	20
	Providence	41 45	71 15	....do ...	....do	20
	Fall River	41 30	71 00	....do ...	....do	20
Rhode Island	Burrilville	41 45	71 30	....do ...	....do	20
	Narragansett bay	41 30	71 15	....do ...	....do	20
	Kent	41 30	71 30	....do ...	....do	20
	Sakonnet	41 15	71 00	....do ...	....do	20
	Newport	41 15	71 15	....do ...	....do	20
	Charlestown	41 15	71 30	....do ...	....do	20
	Block island	41 00	71 30	....do ...	....do	20
Rhode Island and Connecticut.	Putnam	41 45	71 45	....do ...	....do	20
	Moosup	41 30	71 45	....do ...	....do	20
Rhode Island, Connecticut, and New York.	Stonington	41 15	71 45	....do ...	....do	20
Connecticut	Meriden	41 30	72 45	....do ...	....do	20
	Waterbury	41 30	73 00	....do ...	....do	20
	New Milford	41 30	73 15	....do ...	....do	20
	New Haven	41 15	72 45	....do ...	....do	20
	Derby	41 15	73 00	....do ...	....do	20
	Bridgeport	41 00	73 00	....do ...	....do	20
	Norwalk	41 00	73 15	....do ...	....do	20
	Danbury	41 15	73 15	....do ...	....do	20
	Winsted	41 45	73 00	....do ...	....do	20
	New London	41 15	72 00	....do ...	....do	20
	Tolland	41 45	72 15	....do ...	....do	20
	Hartford	41 45	72 30	....do ...	....do	20
	Granby	41 45	72 45	....do ...	....do	20
	Saybrook	41 30	75 15	....do ...	....do	20
	Guilford	41 15	72 30	....do ...	....do	20
	Woodstock	41 45	72 00	....do ...	....do	20
	Gilead	41 30	72 15	....do ...	....do	20
	Middletown	41 30	72 30	....do ...	....do	20
	Norwich	41 30	72 00	....do ...	....do	20
New York and Connecticut.	Stamford	41 00	73 30	....do ...	....do	20

Atlas sheets engraved to June 30, 1892—Continued.

Locality.	Name of sheet.	Designation of sheet.				Area covered.	Scale.	Contour interval.
		Lat.		Long.				
		°	′	°	′			Feet.
New York	Brooklyn	40	30	73	45	1/16 degree	1:62500	20
New York and New Jersey.	Harlem	40	45	73	45	do	do	20
	Staten island	40	30	74	00	do	do	20
	Ramapo	41	00	74	00	do	do	20
	Greenwood lake	41	00	74	15	do	do	20
	Tarrytown	41	00	73	45	do	do	20
New Jersey	Franklin	41	00	74	30	do	do	20
	Paterson	41	00	74	00	do	do	20
	Morristown	40	45	74	15	do	do	20
	Lake Hopatcong	40	45	74	30	do	do	20
	Hackettstown	40	45	74	45	do	do	20
	Plainfield	40	30	74	15	do	do	20
	Somerville	40	30	74	30	do	do	20
	High Bridge	40	30	74	45	do	do	20
	Sandy Hook	40	15	74	00	do	do	10
	New Brunswick	40	15	74	15	do	do	10
	Princeton	40	15	74	30	do	do	10
	Asbury Park	40	00	74	00	do	do	10
	Cassville	40	00	74	15	do	do	10
	Bordentown	40	00	74	30	do	do	10
	Barnegat	39	45	74	00	do	do	10
	Whitings	39	45	74	15	do	do	10
	Pemberton	39	45	74	30	do	do	10
	Mount Holly	39	45	74	45	do	do	10
	Long Beach	39	30	74	00	do	do	10
	Little Egg Harbor	39	30	74	15	do	do	10
	Mullicas	39	30	74	30	do	do	10
	Hammonton	39	30	74	45	do	do	10
	Glassboro	39	30	75	00	do	do	10
	Salem	39	30	75	15	do	do	10
	Atlantic City	39	15	74	15	do	do	10
	Great Egg Harbor	39	15	74	30	do	do	10
	Tuckahoe	39	15	74	45	do	do	10
	Bridgeton	39	15	75	00	do	do	10
	Sea Isle	39	00	74	30	do	do	10
	Dennisville	39	00	74	45	do	do	10
	Maurice cove	39	00	75	00	do	do	10
	Cape May	38	45	74	45	do	do	10
New Jersey and Pennsylvania.	Wallpack	41	00	74	45	do	do	20
	Delaware Water Gap	40	45	75	00	do	do	20
	Easton	40	30	75	00	do	do	20
	Lambertville	40	15	74	45	do	do	20
	Burlington	40	00	74	45	do	do	20
	Philadelphia	39	45	75	00	do	do	20
Pennsylvania	Scranton	41	15	75	30	do	do	20
	Hazelton	40	45	75	45	do	do	20
	Catawissa	40	45	76	15	do	do	20
	Lykens	40	30	76	30	do	do	20
	Doylestown	40	15	75	00	do	do	20
	Quakertown	40	15	75	15	do	do	20
	Lebanon	40	15	76	15	do	do	20
	Germantown	40	00	75	00	do	do	20

Atlas sheets engraved to June 30, 1892—Continued.

Locality.	Name of sheet.	Designation of sheet.				Area covered.	Scale.	Contour interval.
		Lat.		Long.				
		°	'	°	'			*Feet.*
Pennsylvania	Shamokin	40	45	76	30	$\frac{1}{16}$ degree	6:62500	20
	Pottsville	40	30	76	00	...do...	...do...	20
	Dundaff	41	30	75	30	...do...	...do...	20
	Honesdale	41	30	75	15	...do...	...do...	20
	Harrisburg	40	15	76	45	...do...	...do...	20
	Hummelstown	40	15	76	30	...do...	...do...	20
New Jersey and Delaware	Bayside	39	15	75	15	...do...	...do...	10
Maryland	Baltimore	39	10	76	30	...do...	...do...	20
	Brandywine	38	30	76	45	...do...	...do...	20
	Annapolis	38	45	76	15	...do...	...do...	20
	Wicomico	38	15	76	30	...do...	...do...	20
	Owensville	38	45	76	30	...do...	...do...	20
	Relay	39	00	76	30	...do...	...do...	20
	Ellicott	39	15	76	45	...do...	...do...	20
	Drum Point	38	15	76	15	...do...	...do...	20
	Prince Fredericktown	38	30	76	30	...do...	...do...	20
	Laurel	39	00	76	45	...do...	...do...	20
	Leonardtown	38	15	76	30	...do...	...do...	20
Maryland and District of Columbia.	East Washington	38	45	76	45	...do...	...do...	20
Maryland, District of Columbia, and Virginia.	West Washington	38	45	77	00	...do...	...do...	20
	Mount Vernon	38	30	77	00	$\frac{1}{4}$ degree.	1:125000	50
Maryland, Virginia, and West Virginia.	Harper's Ferry	39	00	77	30	...do...	...do...	100
	Romney	39	00	78	30	...do...	...do...	100
Maryland and West Virginia.	Piedmont	39	00	79	00	...do...	...do...	100
Maryland and Virginia	Frederick	39	00	77	00	...do...	...do...	50
	Fredericksburg	38	00	77	00	...do...	...do...	50
	Point Lookout	38	00	76	15	$\frac{1}{16}$ degree	1:62500	20
	Piney point	38	00	76	30	...do...	...do...	20
	Montross	38	00	76	45	...do...	...do...	20
Virginia	Warrenton	38	30	77	30	$\frac{1}{4}$ degree.	1:125000	50
	Luray	38	30	78	00	...do...	...do...	100
	Spottsylvania	38	00	77	30	...do...	...do...	50
	Gordonsville	38	00	78	00	...do...	...do...	100
	Harrisonburg	38	00	78	00	...do...	...do...	100
	Goochland	37	30	77	30	...do...	...do...	50
	Palmyra	37	30	78	00	...do...	...do...	50
	Buckingham	37	30	78	30	...do...	...do...	100
	Lexington	37	30	79	00	...do...	...do...	100
	Natural bridge	37	30	79	30	...do...	...do...	100
	Farmville	37	00	78	00	...do...	...do...	50
	Roanoke	37	00	79	30	...do...	...do...	100
	Appomattox	37	00	78	30	...do...	...do...	50
	Lynchburg	37	00	79	00	...do...	...do...	100
Virginia and West Virginia.	Winchester	39	00	78	00	...do...	...do...	100
	Woodstock	38	30	78	30	...do...	...do...	100
	Franklin	38	30	79	00	...do...	...do...	100
	Beverly	38	30	79	30	...do...	...do...	100
	Staunton	38	00	79	00	...do...	...do...	100
	Monterey	38	00	79	30	...do...	...do...	100
	Lewisburg	37	30	80	00	...do...	...do...	100

Atlas sheets engraved to June 30, 1892—Continued.

Locality.	Name of sheet.	Designation of sheet.				Area covered.	Scale.	Contour interval.
		Lat.		Long.				
		°	′	°	′			Feet.
Virginia and West Virginia.	Christiansburg	37	00	80	00	¼ degree.	1:125000	100
	Dublin	37	00	80	30	...do...	...do...	100
	Pocahontas	37	00	81	00	...do...	...do...	100
	Tazewell	37	00	81	30	...do...	...do...	100
West Virginia	St. George	39	00	79	30	...do...	...do...	100
	Huntersville	38	00	80	00	...do...	...do...	100
	Nicholas	38	00	80	30	...do...	...do...	100
	Kanawha Falls	38	00	81	00	...do...	...do...	100
	Hinton	37	30	80	30	...do...	...do...	100
	Raleigh	37	30	81	00	...do...	...do...	100
	Oceana	37	30	81	30	...do...	...do...	100
	Charleston	38	00	81	30	...do...	...do...	100
West Virginia and Ohio	Huntington	38	00	82	00	...do...	...do...	100
West Virginia, Virginia and Kentucky.	Warfield	37	30	82	00	...do...	...do...	100
Kentucky	Prestonburg	37	30	82	30	...do...	...do...	100
	Salyersville	37	30	83	00	...do...	...do...	100
	Hazard	37	00	83	00	...do...	...do...	100
	Manchester	37	00	83	30	...do...	...do...	100
	Beattyville	37	30	83	30	...do...	...do...	100
	Richmond	37	30	84	00	...do...	...do...	100
Kentucky and Virginia	Whitesburg	37	00	82	30	...do...	...do...	100
	Grundy	37	00	82	00	...do...	...do...	100
Virginia and North Carolina.	Hillsville	36	30	80	30	...do...	...do...	100
	Wytheville	36	30	81	00	...do...	...do...	100
Virginia, North Carolina and Tennessee.	Abingdon	36	30	81	30	...do...	...do...	100
Virginia and Tennessee	Bristol	36	30	82	00	...do...	...do...	100
Kentucky, Virginia and Tennessee.	Estillville	36	30	82	30	...do...	...do...	100
	Jonesville	36	30	83	00	...do...	...do...	100
	Cumberland Gap	36	30	83	30	...do...	...do...	100
Kentucky and Tennessee.	Williamsburg	36	30	84	00	...do...	...do...	100
North Carolina	Wilkesboro	36	00	81	00	...do...	...do...	100
	Morganton	35	30	81	30	...do...	...do...	100
	Cowee	35	00	83	00	...do...	...do...	100
North Carolina and Tennessee.	Roan mountain	36	00	82	00	...do...	...do...	100
	Cranberry	36	00	81	30	...do...	...do...	100
	Greenville	36	00	82	30	...do...	...do...	100
	Mount Mitchell	35	30	82	00	...do...	...do...	100
	Asheville	35	30	82	30	...do...	...do...	100
	Mount Guyot	35	30	83	00	...do...	...do...	100
	Knoxville	35	30	83	30	...do...	...do...	100
	Nantahalah	35	00	83	30	...do...	...do...	100
	Murphy	35	00	84	00	...do...	...do...	100
North Carolina and South Carolina	Saluda	35	00	82	00	...do...	...do...	100
	Pisgah	35	00	82	30	...do...	...do...	100
Tennessee	Morristown	36	00	83	00	...do...	...do...	100
	Maynardville	36	00	83	30	...do...	...do...	100
	Loudon	35	30	84	00	...do...	...do...	100
	Kingston	35	30	84	30	...do...	...do...	100
	Cleveland	35	00	84	30	...do...	...do...	100
	Chattanooga	35	00	85	00	...do...	...do...	100
	Pikeville	35	30	85	00	...do...	...do...	100

Atlas sheets engraved to June 30, 1892—Continued.

Locality.	Name of sheet.	Designation of sheet.				Area covered.	Scale.	Contour interval.
		Lat.		Long.				
		°	′	°	′			*Feet.*
South Carolina	Pickens	34	30	82	30	¼ degree	1:125000	100
	Abbeville	34	00	82	00	do	do	50
South Carolina and Georgia.	Walhalla	34	30	83	00	do	do	50
	Elberton	34	00	82	30	do	do	100
	McCormick	33	30	82	00	do	do	50
Georgia	Dahlonega	34	30	83	30	do	do	100
	Ellijay	34	30	84	00	do	do	100
	Dalton	34	30	84	30	do	do	100
	Carnesville	34	00	83	00	do	do	100
	Gainesville	34	00	83	30	do	do	100
	Suwanee	34	00	84	00	do	do	100
	Cartersville	34	00	84	30	do	do	100
	Atlanta	33	30	84	00	do	do	100
	Marietta	33	30	84	30	do	do	50
Georgia and Alabama	Ringgold	34	30	85	00	do	do	100
	Rome	34	00	85	00	do	do	100
	Tallapoosa	33	30	85	00	do	do	100
Alabama	Stevenson	34	30	85	30	do	do	100
	Scottsboro	34	30	86	00	do	do	100
	Huntsville	34	30	86	30	do	do	100
	Fort Payne	34	00	85	30	do	do	100
	Gadsden	34	00	86	00	do	do	100
	Cullman	34	00	86	30	do	do	100
	Anniston	33	30	85	30	do	do	100
	Springville	33	30	86	00	do	do	100
	Birmingham	33	30	86	30	do	do	100
	Ashland	33	00	85	30	do	do	100
	Talladega	33	00	86	00	do	do	100
	Bessemer	33	00	86	30	do	do	100
	Clanton	32	30	86	30	do	do	50
Louisiana	Bonnett Carre	30	00	90	15	$\frac{1}{16}$ degree	1:62500	5
	Spanish Fort	30	00	90	00	do	do	None.
	New Orleans	29	45	90	00	do	do	5
	Lac des Allemands	29	45	90	30	do	do	5
	St. Bernard	25	45	89	45	do	do	5
	Hahnville	29	45	90	15	do	do	5
	Thibodeaux	29	45	90	45	do	do	5
	Pointe à la Hache	29	30	89	45	do	do	5
	Quarantine	29	15	89	30	do	do	5
	Barataria	29	30	90	00	do	do	5
	Fort Livingstone	29	15	89	45	do	do	None.
	Chef Menteur	30	00	89	45	do	do	None.
	Cut Off	29	30	90	15	do	do	5
	Cheniere Caminada	29	00	90	00	do	do	None.
Florida	Dunellon	29	00	82	15	do	do	10
	Arredondo	29	30	82	15	do	do	10
Wisconsin	Sun Prairie	43	00	89	00	do	do	20
	Waterloo	43	00	88	45	do	do	20
	Madison	43	00	89	15	do	do	20
	Koshkonong	42	45	88	45	do	do	20
	Stoughton	42	45	89	00	do	do	20

Atlas sheets engraved to June 30, 1892—Continued.

Locality.	Name of sheet.	Designation of sheet.				Area covered.	Scale.	Contour interval.
		Lat.		Long.				
		°	′	°	′			*Feet.*
Wisconsin	Evansville	42	45	89	15	$\frac{1}{16}$ degree	1:62500	20
	Whitewater	42	45	88	30	do	do	20
	Eagle	42	45	88	15	do	do	20
	Watertown	43	00	88	30	do	do	20
	Port Washington	43	15	87	45	do	do	20
	Bayview	42	45	87	45	do	do	20
	Racine	42	30	87	45	do	do	20
	Oconomowoc	43	00	88	15	do	do	20
	Waukesha	43	00	88	00	do	do	20
	Milwaukee	43	00	87	45	do	do	20
	Muskego	42	45	88	00	do	do	20
Illinois	Desplaines	41	45	87	45	do	do	10
	Riverside	41	30	87	45	do	do	10
	Joliet	41	30	88	00	do	do	10
	Wilmington	41	15	88	00	do	do	10
	Morris	41	15	88	15	do	do	10
	Marseilles	41	15	88	30	do	do	10
	Ottawa	41	15	88	45	do	do	10
	Chicago	41	45	87	30	do	do	5
Illinois and Indiana	Calumet	41	30	87	30	do	do	10
Iowa	Maquoketa	42	00	90	30	do	do	20
	Baldwin	42	00	90	45	do	do	20
	Monticello	42	00	91	00	do	do	20
	Anamosa	42	00	91	15	do	do	20
	Marion	42	00	91	30	do	do	20
	Shellsburg	42	00	91	45	do	do	20
	DeWitt	41	45	90	30	do	do	20
	Wheatland	41	45	90	45	do	do	20
	Tipton	41	45	91	00	do	do	20
	Mechanicsville	41	45	91	15	do	do	20
	Cedar Rapids	41	45	91	30	do	do	20
	Amana	41	45	91	45	do	do	20
	West Liberty	41	30	91	15	do	do	20
	Iowa City	41	30	91	30	do	do	20
	Oxford	41	30	91	45	do	do	20
	Davenport	41	30	90	30	do	do	20
	Durant	40	30	90	45	do	do	20
	Wilton Junction	41	30	91	00	do	do	20
Iowa and Illinois	Clinton	41	45	90	00	do	do	20
	Goose Lake	41	45	90	15	do	do	20
	Leclaire	41	30	90	15	do	do	20
	Savanna	42	00	90	00	do	do	20
Missouri and Illinois	Louisiana	39	00	91	00	$\frac{1}{4}$ degree.	1:125000	50
	St. Louis, East	38	30	90	00	$\frac{1}{16}$ degree	1:62500	20
Missouri	St. Louis, West	38	30	90	15	do	do	20
	Mexico	39	00	91	30	$\frac{1}{4}$ degree.	1:125000	50
	Moberly	39	00	92	00	do	do	50
	Glasgow	39	00	92	30	do	do	50
	Marshall	39	00	93	00	do	do	50
	Lexington	39	00	93	30	do	do	50
	Independence	39	00	94	00	do	do	50
	Hermann	38	30	91	00	do	do	50

Atlas sheets engraved to June 30, 1892—Continued.

Locality.	Name of sheet.	Designation of sheet.				Area covered.	Scale.	Contour interval.
		Lat.		Long.				
		°	'	°	'			Feet.
Missouri	Fulton	38	30	91	30	¼ degree.	1:125000	50
	Jefferson City	38	30	92	00	....do...	....do.....	50
	Boonville	38	30	92	30	....do...	....do.....	50
	Sedalia	30	30	93	00	....do...	....do.....	50
	Warrensburg	38	30	93	30	....do...	....do.....	50
	Harrisonville	38	30	94	00	....do...	....do.....	50
	Tuscumbia	38	00	92	00	....do...	....do.....	50
	Versailles	38	00	92	30	....do...	....do.....	50
	Warsaw	38	00	93	00	....do...	....do.....	50
	Clinton	38	00	93	30	....do...	....do.....	50
	Butler	38	00	94	00	....do...	....do.....	50
	Bolivar	37	30	93	00	....do...	....do.....	50
	Stockton	37	30	93	30	....do...	....do.....	50
	Nevada	37	30	94	00	....do...	....do.....	50
	Springfield	37	00	93	00	....do...	....do.....	50
	Greenfield	37	00	93	30	....do...	....do.....	50
	Carthage	37	00	94	00	....do...	....do.....	50
Missouri and Kansas	Atchison	39	30	95	00	....do...	....do.....	50
	Kansas City	39	00	94	30	....do...	....do.....	50
	Olathe	38	30	94	30	....do...	....do.....	50
	Mound City	38	00	94	30	....do...	....do.....	50
	Fort Scott	37	30	94	30	....do...	....do.....	50
	Joplin	37	00	94	30	....do...	....do.....	50
Kansas	Hiawatha	39	30	95	30	....do...	....do.....	50
	Seneca	39	30	96	00	....do...	....do.....	50
	Marysville	39	30	96	30	....do...	....do.....	50
	Oskaloosa	39	00	95	00	....do...	....do.....	50
	Topeka	39	00	95	30	... do...	....do.....	50
	Wamego	39	00	96	00	....do...	....do.....	50
	Junction City	39	00	96	30	....do...	....do.....	50
	Lawrence	38	30	95	00	....do...	....do.....	50
	Burlingame	38	30	95	30	....do...	....do.....	50
	Eskridge	38	30	96	00	....do...	....do.....	50
	Parkerville	38	30	96	30	....do...	....do.....	50
	Abilene	38	30	97	00	....do...	....do.....	50
	Garnett	38	00	95	00	....do...	....do.....	50
	Burlington	38	00	95	30	....do...	....do.....	50
	Emporia	38	00	96	00	....do...	....do.....	50
	Cottonwood falls	38	00	96	30	....do...	....do.....	50
	Newton	38	00	97	00	....do...	....do.....	50
	Hutchinson	38	00	97	30	....do...	....do.....	20
	Lyons	38	00	98	00	....do...	....do.....	20
	Great Bend	38	00	98	30	....do...	....do.....	20
	Larned	38	00	99	00	....do...	....do.....	20
	Ness City	38	00	99	30	....do...	....do.....	20
	Iola	37	30	95	00	....do...	....do.....	50
	Fredonia	37	30	95	30	....do...	....do.....	50
	Eureka	37	30	96	00	....do...	....do.....	50
	Eldorado	37	30	96	30	....do...	....do.....	50
	Wichita	37	30	97	00	....do...	....do.....	50
	Cheney	37	30	97	30	....do...	....do.....	20
	Kingman	37	30	98	00	....do...	....do.....	20

Atlas sheets engraved to June 30, 1892—Continued.

Locality.	Name of sheet.	Designation of sheet.				Area covered.	Scale.	Contour interval.
		Lat.		Long.				
		°	′	°	′			*Feet.*
Kansas	Pratt	37	30	98	30	½ degree.	1:125900	20
	Kinsley	37	30	99	00	do	do	20
	Spearville	37	30	99	30	do	do	20
	Parsons	37	00	95	00	do	do	50
	Independence	37	00	95	30	do	do	50
	Sedan	37	00	96	00	do	do	50
	Burden	37	00	96	30	do	do	50
	Wellington	37	00	97	00	do	do	50
	Caldwell	37	00	97	30	do	do	20
	Anthony	37	00	98	00	do	do	20
	Dodge	37	30	100	00	do	do	20
	Meade	37	00	100	00	do	do	20
	Clay Center	39	00	97	00	do	do	20
	Concordia	39	30	97	30	do	do	20
	Minneapolis	39	00	97	30	do	do	20
	Medicine Lodge	37	00	98	30	do	do	20
	Coldwater	37	00	99	00	do	do	20
	Salina	38	30	97	30	do	do	20
	Washington	39	00	97	00	do	do	20
Arkansas	Mountain View	36	30	92	00	do	do	50
	Marshall	35	30	92	30	do	do	50
	Morrillton	35	00	92	30	do	do	50
	Dardanelle	35	00	93	00	do	do	50
	Magazine mountain	35	00	93	30	do	do	50
	Fort Smith	35	00	94	00	do	do	50
	Benton	34	30	92	30	do	do	50
	Hot Springs	34	30	93	00	do	do	50
	Mount Ida	34	30	93	30	do	do	50
	Poteau mountain	34	30	94	00	do	do	50
	Aplin	35	00	93	00	1 degree.	1:62500	20
	Greenwood	35	00	94	15	do	do	20
	Atkins	35	00	92	45	do	do	20
	Washburn	35	00	94	00	do	do	20
	Petit Jean	35	00	92	45	do	do	20
	Danville	35	00	93	15	do	do	20
	Russellville	35	15	93	00	do	do	20
	Clarksville	35	15	93	15	do	do	20
	Coal Hill	35	15	93	30	do	do	20
	Van Buren	35	15	94	15	do	do	20
	Arbuckle	35	15	94	00	do	do	20
	Ozark	35	15	93	45	do	do	20
	Oak mountain	35	15	92	45	do	do	20
	Mountain Home	36	00	92	00	½ degree	1:125000	50
	Batesville	35	30	91	30	do	do	50
Texas	Dallas	32	30	96	30	do	do	20
	Fort Worth	32	30	97	00	do	do	20
	Weatherford	32	30	97	30	do	do	50
	Palo Pinto	32	30	98	00	do	do	50
	Breckenridge	32	30	98	30	do	do	50
	Albany	32	30	99	00	do	do	50
	Anson	32	30	99	30	do	do	50
	Cleburne	32	00	97	00	do	do	50
	Granbury	32	00	97	30	do	do	50

Atlas sheets engraved to June 30, 1892—Continued.

Locality.	Name of sheet.	Designation of sheet.				Area covered.	Scale.	Contour interval.
		Lat.		Long.				
		°	'	°	'			*Feet.*
Texas	Stephenville	32	00	98	00	¼ degree.	1:125000	50
	Eastland	32	00	98	30	....do ...	....do	50
	Meridian	31	30	97	30	....do ...	....do	50
	Hamilton	31	30	98	00	....do ...	....do	50
	Brownwood	31	30	98	30	....do ...	....do	50
	Coleman	31	30	99	00	....do ...	....do	50
	Gatesville	31	00	97	30	....do ...	....do	50
	Lampasas	31	00	98	00	....do ...	....do	50
	San Saba	31	00	98	30	....do ...	....do	50
	Brady	31	00	99	00	....do ...	....do	50
	Taylor	30	30	97	00	....do ...	....do	50
	Georgetown	30	30	97	30	....do ...	....do	50
	Burnet	30	30	98	00	....do ...	....do	50
	Llano	30	30	98	30	....do ...	....do	50
	Mason	30	30	99	00	....do ...	....do	50
	Bastrop	30	00	97	00	....do ...	....do	50
	Austin	30	00	97	30	....do ...	....do	50
	Blanco	30	00	98	00	....do ...	....do	50
	Fredericksburg	30	00	98	30	....do ...	....do	50
	Kerrville	30	00	99	00	....do ...	....do	50
	Albany	32	30	99	00	....do ...	....do	50
	Hayrick	31	30	100	00	....do ...	....do	50
	San Angelo	31	00	100	00	....do ...	....do	50
	Waco	31	30	97	00	....do ...	....do	50
	Temple	31	00	97	00	....do ...	....do	50
	Eden	31	00	99	30	....do ...	....do	50
	Abilene	32	00	99	30	....do ...	....do	50
	Ballinger	31	30	99	30	....do ...	....do	50
Montana	Fort Benton	47	00	110	00	1 degree.	1:250000	200
	Great Falls	47	00	111	00	....do ...	....do	200
	Big Snowy mountain	46	00	109	00	....do ...	....do	200
	Little Belt mountain	46	00	110	00	....do ...	....do	200
	Fort Logan	46	00	111	00	....do ...	....do	200
	Helena	46	00	112	00	....do ...	....do	200
	Livingston	45	00	110	00	....do ...	....do	200
	Three Forks	45	00	111	00	....do ...	....do	200
	Dillon	45	00	112	00	....do ...	....do	200
	Big Timber	45	30	109	30	¼ degree.	1:125000	50
	Stillwater	45	30	109	00	....do ...	....do	50
Yellowstone National Park.	Canyon	44	30	110	00	....do ...	....do	100
	Gallatin	44	30	110	30	....do ...	....do	100
	Lake	44	00	110	00	....do ...	....do	100
	Shoshone	44	00	110	30	....do ...	....do	100
Idaho	Camas Prairie	43	00	115	00	....do ...	....do	100
	Mount Home	43	00	115	30	....do ...	....do	100
	Bisuka	43	00	116	00	....do ...	....do	25, 50, 100
	Boise	43	30	116	00	....do ...	....do	25, 50, 100
Oregon	Klamath	42	00	121	00	1 degree.	1:250000	200
	Ashland	42	00	122	00	....do ...	....do	200
Colorado	East Denver	39	30	104	30	¼ degree.	1:125000	50
	Crested Butte	38	45	106	45	1/16 degree	1:62500	100
	Anthracite	38	45	107	00	....do ...	....do	100
	Arroya	38	30	103	00	¼ degree.	1:125000	100

Atlas sheets engraved to June 30, 1892—Continued.

Locality.	Name of sheet.	Designation of sheet.				Area covered.	Scale.	Contour interval.
		Lat.		Long.				
		°	′	°	′			*Feet.*
Colorado	Sanborn	38	30	103	30	¼ degree.	1:125000	100
	Big Springs	38	30	104	00	do	do	100
	Las Animas	38	00	103	00	do	do	100
	Catlin	38	00	103	30	do	do	100
	Nepesta	38	00	104	00	do	do	100
	Pueblo	38	00	104	30	do	do	100
	Higbee	37	30	103	00	do	do	100
	Timpas	37	30	103	30	do	do	100
	Apishapa	37	30	104	00	do	do	100
	Kit Carson	38	30	102	30	do	do	25
	Vilas	37	00	102	00	do	do	25
	Lamar	38	00	102	30	do	do	25
	Cheyenne Wells	38	30	102	00	do	do	25
	Limon	39	00	103	30	do	do	25
	Leadville	39	00	106	00	do	do	25, 50, 100
	Huerfano Park	37	30	105	00	do	do	25, 50, 100
	Walsenburg	37	30	104	30	do	do	25, 50, 100
	Colorado Springs	38	30	104	30	do	do	25, 50, 100
	El Moro	37	00	104	00	do	do	25, 50, 100
	Canyon city	38	00	105	00	do	do	25, 50, 100
	Trinidad	37	00	104	30	do	do	25, 50, 100
	Mesa de Maya	37	00	103	30	do	do	25, 50, 100
	Mount Carriso	37	00	103	00	do	do	25, 50, 100
	Two Butte	37	30	102	30	do	do	25 and 50
	Springfield	37	00	102	30	do	do	25 and 50
Colorado and Kansas	Grenada	38	00	102	00	do	do	25
Colorado and Utah	Ashley	40	00	109	00	1 degree.	1:250000	250
	East Tavaputs	39	00	109	00	do	do	250
	La Sal	38	00	109	00	do	do	250
	Abajo	37	00	109	00	do	do	250
Utah	Uinta	40	00	110	00	do	do	250
	Salt lake	40	00	111	00	do	do	250
	Tooele valley	40	00	112	00	do	do	250
	Price River	39	00	110	00	do	do	250
	Manti	39	00	111	00	do	do	250
	Sevier Desert	39	00	112	00	do	do	250
	San Rafael	38	00	110	00	do	do	250
	Fish Lake	38	00	111	00	do	do	250
	Beaver	38	00	112	00	do	do	250
	Henry mountain	37	00	110	00	do	do	250
	Escalante	37	00	111	00	do	do	250
	Kanab	37	00	112	00	do	do	250
	St. George	37	00	113	00	do	do	250
Utah and Nevada	Pioche	37	00	114	00	do	do	250
Nevada	Paradise	41	00	117	00	do	do	200
	Disaster	41	00	118	00	do	do	200
	Long valley	41	00	119	00	do	do	200
	Granite range	40	00	119	00	do	do	200
	Carson	39	00	119	30	¼ degree.	1:125000	100
	Reno	39	30	119	30	do	do	100
	Wabuska	39	30	119	00	do	do	100
	Wadsworth	39	30	119	00	do	do	100
	Truckee	39	00	120	00	do	do	100

Atlas sheets engraved to June 30, 1892—Continued.

Locality.	Name of sheet.	Designation of sheet.				Area covered.	Scale.	Contour interval.
		Lat.		Long.				
		°	′	°	′			*Feet.*
Nevada and California..	Wellington	38	30	119	00	¼ degree.	1:125000	100
	Markleeville	38	30	119	30	....do ...	....do	100
California	Alturas	41	00	120	00	1 degree.	1:250000	200
	Modoc lava bed	41	00	121	00	....do ...	....do	200
	Shasta	41	00	122	00	....do ...	....do	200
	Honey lake	40	00	120	00	....do ...	....do	200
	Lassen peak	40	00	121	00	....do ...	....do	200
	Red Bluff	40	00	122	00	....do ...	....do	200
	Downieville	39	30	120	30	¼ degree.	1:125000	50
	Bidwell Bar	39	30	121	00	....do ...	....do	50
	Chico	39	30	121	30	....do ...	....do	100
	Colfax	39	00	120	30	....do ...	....do	100
	Nevada City	39	00	121	00	....do ...	....do	100
	Marysville	39	00	121	30	....do ...	....do	100
	Placerville	38	30	120	30	....do ...	....do	100
	Sacramento	38	30	121	00	....do ...	....do	100
	Jackson	38	00	120	30	....do ...	....do	100
	Pyramid peak	38	30	120	00	....do ...	....do	100
	Sierraville	39	30	120	00	....do ...	....do	100
New Mexico	Largo	36	00	107	00	1 degree.	1:250000	200
	Chaco	36	00	108	00	....do ...	....do	200
	Santa Clara	35	30	106	00	¼ degree.	1:125000	100
	Jemez	35	30	106	30	....do ...	....do	100
	Albuquerque	35	00	106	30	....do ...	....do	50
	Mount Taylor	35	00	107	00	1 degree.	1:250000	200
	Wingate	35	00	108	00	....do ...	....do	200
	Las Vegas	35	30	105	00	¼ degree.	1:125000	50
	Watrous	35	30	104	30	....do ...	....do	50
	Bernal	35	00	105	00	....do ...	....do	50
	Corazon	35	00	104	30	....do ...	....do	50
	Las Cruces	32	00	106	30	....do ...	....do	25 and 50
	Lamy	35	00	105	30	....do ...	....do	50 and 100
	San Pedro	35	00	106	00	....do ...	....do	50 and 100
	Santa Fe	35	30	105	30	....do ...	....do	100
New Mexico and Arizona.	Canyon de Chelly	36	00	109	00	1 degree.	1:250000	200
	Fort Defiance	35	00	109	00	....do ...	....do	200
	St. Johns	34	00	109	00	....do ...	....do	200
Arizona	Marsh Pass	36	00	110	00	....do ...	....do	200
	Echo cliffs	36	00	111	00	....do ...	....do	250
	Kaibab	36	00	112	00	....do ...	....do	250
	Mount Trumbull	36	00	113	00	....do ...	....do	250
	Tusayan	35	00	110	00	....do ...	....do	200
	San Francisco mountain.	35	00	111	00	....do ...	....do	250
	Chino	35	00	112	00	....do ...	....do	250
	Diamond Creek	35	00	113	00	....do ...	....do	250
	Holbrook	34	00	110	00	....do ...	....do	200
	Verde	34	00	111	00	....do ...	....do	200
	Prescott	34	00	112	00	....do ...	....do	200
Arizona and Nevada	St. Thomas	36	00	114	00	....do ...	....do	250
Arizona, Nevada, and California.	Camp Mohave	35	00	114	00	....do ...	....do	250

During the year contracts for engraving topographic atlas sheets were awarded to Harris & Sons, 10 topographic atlas sheets; Evans & Bartle, 75 topographic atlas sheets.

Respectfully submitted.

S. J. KÜBEL,
Chief Engraver.

HON. J. W. POWELL,
Director U. S. Geological Survey.

REPORT OF MR. CHAS. C. DARWIN.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
DIVISION OF LIBRARY AND DOCUMENTS,
Washington, D. C., June 30, 1892.

SIR: The organization of this division during the fiscal year ending to-day has remained as in former years.

The work of the division consists in (1) the administration of the library; (2) the sale, exchange, and distribution of the publications of the Survey, and (3) the voluminous correspondence arising from both these branches.

LIBRARY.

The library now consists of 99,398 books, pamphlets, and maps, of which 6,209 were added during the year just closed. Of the accessions, 5,703 were obtained by gift and exchange and 506 by purchase. The total amount expended in the purchase of books, pamphlets, and maps during the year was $688.22.

The average circulation remains as last year, about 1,000 per month. This circulation, however, is not an adequate measure of the use of the library, which is largely one of reference, and its contents are extensively consulted without being withdrawn.

A complete author's card catalogue of books and pamphlets is kept fully up to date, and now comprises more than 70,000 cards. In addition to this, three special bibliographies are in various stages of preparation. These are: (1) Bibliography of American Geology; (2) Bibliography of American Official Geology; (3) Bibliography of the beginning of Geology.

Of the first, 14,400 titles have been collected for verification and revision; of the second, 4,400 cards are ready for the printer; and of the third, more than 2,000 titles have been written.

The growth of the library steadily encroaches on the space available for it, and renders its use and administration gradually more difficult. It now has shelving room for but two-thirds of its contents.

The following table exhibits some details of the library's condition and growth:

Contents of the library, June 30, 1892.

BOOKS.			
On hand June 30, 1891:			
Received by exchange	20,714		
Received by purchase	8,921		
		29,635	
Received during the past year:			
By exchange	1,203		
By purchase	346		
		1,549	
			31,184
PAMPHLETS.			
On hand June 30, 1891:			
Received by exchange	36,640		
Received by purchase	4,577		
		41,217	
Received during the past year:			
By exchange	2,000		
By purchase	160		
		2,160	
			43,377
MAPS.			
Geologic and topographic maps:			
On hand June 30, 1891	22,337		
Received during the year	2,500		
			24,837
Total number of books, pamphlets, and maps			99,398

PUBLICATIONS.

Under the law some of the publications of the Survey can be disposed of only by sale or exchange; others are distributed gratuitously. The work of distribution during the year has been as follows:

Exchanges.—In the way of exchange 21,553 books and pamphlets and 21,266 map sheets were sent out during the year. In return the library received 2,203 books and pamphlets and 2,500 map sheets.

The distribution of publications to those regularly entitled to receive them by way of exchange has been as follows:

Exchange distribution.

757 copies each Bulletins 62, 65, 67–81	12,869
Tenth Annual Report, two volumes	3,068
Total books	15,937
United States atlas sheets	21,266
Total	37,203

The handling of exchanges is the largest branch of the work of the division, taking about one-half of the force and about three-fourths of the appropriation for "the purchase of necessary books for the library, and the payment for transmission of public documents through the Smithsonian bureau of international exchange." The amount paid the Smithsonian Institution on account of the exchanges for the fiscal year 1890-'91 was $1,811.78, leaving for the purchase of books $688.22. The amount due on this account for the year now ended is not exactly known, but it will be about the same.

Sales.—The sale account shows that 4,337 copies of the Survey's publications were sold during the year, yielding a return of $1,392.50. This is a slight increase over the preceding year, when 4,187 copies were sold, yielding a return of $1,505.22.

Free distribution.—During the year 9,112 books and 9,848 map sheets were gratuitously distributed through this division.

The summary of distribution is therefore:

Books distributed gratuitously	9, 112
Books sent out in exchange	21, 553
Books sold	4, 337
Atlas sheets sent gratuitously	9, 848
Atlas sheets sent in exchange	21, 266
Total number of books and maps distributed	66, 116

CORRESPONDENCE.

The correspondence of the division has amounted to 13,176 letters sent and 18,647 letters received, a daily average of over 42 letters sent and 62 letters received. The files and indexes of these letters and the records of publications distributed are kept fully up to date.

Respectfully submitted.

Chas. C. Darwin,
Librarian.

Hon. J. W. Powell,
Director U. S. Geological Survey.

REPORT OF MR. W. A. CROFFUT.

Department of the Interior,
U. S. Geological Survey,
Editorial Division,
Washington, D. C., July 1, 1892.

Sir: The work of this division during the fiscal year just closed has consisted of the revision of manuscripts and the reading of proof of the following publications of the Survey. In this work I have, as in previous years, had the able assistance of Mr. George M. Wood, and Mr. W. M. McDevitt has been added to the division. Mr. Costello N. Holford has also been connected with the division throughout the year, and his services as critic and linguist have been very valuable.

Manuscript and proof read.

Manuscript read.	Proof read.
Twelfth Annual Report. Thirteenth Annual Report (in part). Monographs XIX, XX, XXI, XXII, XXIII. Bulletins 83, 84, 85, 86, 90, 92, 93, 94, 95, 96, 97, 98, 99, 101, 102.	Twelfth Annual Report. Monographs XVIII, XX. Bulletins 80 (in part), 81 (in part), 82, 83, 84, 85, 86 (in part).

The aggregate of this work may be stated as follows:

Pages of manuscript read	11,079
Galleys received from Public Printer	1,506
Galleys corrected and returned	1,382
Pages received from Public Printer	8,904
Pages corrected and returned	8,979

During the year the Survey has published Bulletins 71, 72, 73, 74, 75, 76, 78, 79, 80, 81, 82, 83, 91, and part II of the Eleventh Annual Report.

Very respectfully,

W. A. CROFFUT,
Editor.

Hon. J. W. POWELL,
Director U. S. Geological Survey.

REPORT OF MR. W. F. MORSELL.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
MISCELLANEOUS DIVISION,
Washington, D. C., June 30, 1892.

SIR: The work of the fiscal year ending to-day has differed but little either in character or amount from that of the previous year, although the clerical assistance was a little less than formerly.

The number of communications received, briefed, recorded, and appropriately disposed of during the year was 2,500, an average of about eight per day. The number of outgoing letters recorded and forwarded was somewhat greater than this. About one-half of the outgoing letters were written in this division and the remainder elsewhere.

Two reports to the Secretary of the Interior, as in previous years, were prepared each month, viz, (1) a report of the personnel of the Survey with the changes therein, and (2) a report of the operations of the Survey.

The appointment records, kept in this division, show the following facts:

Original appointments recorded during the year	7
Promotions	43
Changes of designation	11
Resignations	13
Dropped from rolls	1

It will be observed that the number of original appointments during the year fell short of the number of retirements by 7.

The records of attendance and the "time" records were, as hereto fore, kept in this division. This work demands a large share of attention.

Beside the general routine work a variety of special matters, including the ordering of printing and supplies, special photographic business, etc., received attention, and, in addition, responses were made daily to calls for information connected with the several branches of the division's work.

Mr. J. R. Walsh and Miss Ella Leary were employed in this division throughout the year, the former as the principal assistant. Both rendered acceptable service. Mr. W. D. Crossman was also employed during the first half of the year, but at the close of that period he was transferred to other work. Since his transfer the division has had the assistance, not continuously, but as occasion required, of Mr. W. M. McDevitt, whose work has been entirely satisfactory.

Respectfully submitted.

WM. F. MORSELL,
In Charge.

Hon. J. W. POWELL,
Director U. S. Geological Survey.

REPORT OF MR. J. D. McCHESNEY.

DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL SURVEY,
Washington, D. C., July 15, 1892.

SIR: I have the honor to submit herewith a detailed statement of the expenditures from the appropriation for the U. S. Geological Survey for the fiscal year ending June 30, 1892, amounting to $587,611.14.

Very respectfully,

JNO. D. McCHESNEY,
Chief Disbursing Clerk.

Hon. J. W. POWELL,
Director U. S. Geological Survey.

ANALYSIS OF DISBURSEMENTS.

Under the following heads appear the total expenditures under the various appropriations for the U. S. Geological Survey:

1. Salaries, office of the Director	$35, 437. 39
2. Salaries of scientific assistants	67, 640. 22
3. Skilled laborers and various temporary employés	14, 972. 06
4. Topography	248, 398. 61
5. Geology	105, 954. 65
6. Paleontology	38, 145. 51
7. Chemical and physical researches	16, 698. 61
8. Preparation of illustrations	15, 866. 93
9. Mineral resources of the United States	9, 751. 51
10. Books for library	2, 036. 36
11. Rent of office rooms	3, 199. 92
12. Geological maps of the United States	31, 498. 85
Total	589, 600. 62

RECAPITULATION.

	Geological Survey.	Salaries, office of Geological Survey.	Geological maps of the United States.	Total.
Appropriation fiscal year ending June 30, 1892.	$536, 400. 00	$35, 540. 00	$60, 000. 00	$631, 940. 00
Expended as per detailed statement herewith	520, 674. 90	35,437. 39	31, 498. 85	587, 611. 14
Bonded railroad accounts settled at U. S. Treasury	1, 989. 48			1, 989. 48
Balance on hand	13, 735. 62	102. 61	28, 501. 15	42, 339. 38

Abstract of disbursements made by Jno. D. McChesney, chief disbursing clerk, U S. Geological Survey, during the fiscal year 1891–'92.

SALARIES, OFFICE OF THE DIRECTOR.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891				
July 31	1	Pay roll of employés	Services, July, 1891	$2, 990. 83
Aug. 29	1	......do	Services, August, 1891	2, 866. 90
29	2	Wm. N. Thomas	Services, August, 1891	50. 50
29	3	May S. Clark	Services, August, 1891	75. 80
Sept. 30	1	Pay roll of employés	Services, September, 1891	2, 898. 60
Oct. 31	1	......do	Services, October, 1891	2, 993. 20
Nov. 30	1	......do	Services, November, 1891	2, 735. 60
Dec. 22	1	Chas. C. Darwin	Services, November, 1891	163. 00
30	2	Pay roll of employés	Services, December, 1891	2, 993. 20
1892				
Jan. 31	1	......do	Services, January, 1892	3, 025. 16
Feb. 29	1	......do	Services, February, 1892	2, 832. 00
Mar. 31	1	......do	Services, March, 1892	3, 026. 50
Apr. 30	1	......do	Services, April, 1892	2, 910. 85
May 31	1	......do	Services, May, 1892	2, 985. 50
June 30	1	......do	Services, June, 1892	2, 889. 75
		Total		35, 437. 39

Abstract of disbursements made by Jno. D. McChesney, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
July 18	1	C. A. White	Traveling expenses	$145.30
24	2	Quartermaster's Department, U. S. A.	Tents, etc	8.72
23	3	Chas. G. Stott & Co	Supplies	17.58
28	4	W. & L. E. Gurley	Topographic supplies	48.00
28	5	Wm. D. Clark & Co	do	39.06
28	6	James K. Cleary	do	2.00
29	7	John C. Parker	do	.75
31	8	John M. Gurley	Services, July 1 to 29, 1891	50.00
31	9	Sam. H. Scudder	Services, July, 1891	210.60
31	10	Alpheus Hyatt	do	168.50
31	11	Ira Sayles	do	117.90
31	12	O. C. Marsh	do	337.00
31	13	J. B. Hatcher	do	250.00
31	14	W. H. Burwell	do	65.00
31	15	W. H. Utterback	do	90.00
31	16	L. P. Bush	do	50.00
31	17	A. L. Sullins	do	55.00
31	18	F. Berger	do	80.00
31	19	Chas. G. Stott & Co	Supplies for illustrations	16.88
31	20	J. Henry Blake	Services, July, 1891	151.60
31	21	C. C. Willard	Rent of offices	266.66
31	22	Pay roll of employés	Services, July, 1891	1,154.00
31	23	do	do	1,188.86
31	24	do	do	980.00
31	25	do	do	906.70
31	26	do	do	1,205.00
31	27	do	do	1,171.40
31	28	do	do	1,145.10
31	29	do	do	597.85
		Total		10,519.46
Aug. 4	1	Stephen Ellis	Services, August 1 to 4, 1891	3.75
4	2	John Johnson	do	3.75
10	3	Victoria Essex	Services, July, 1891	52.00
10	4	Washington Gas Light Co	Laboratory supplies	43.25
10	5	West Shore R. R. Co	Transportation of assistants	14.96
10	6	Jefferson Middleton	Traveling expenses	28.34
12	7	James G. Bowen	Care and forage of public animals	19.50
12	8	Geo. F. Lamborn	Services, August 1 to 10, 1891	16.13
24	9	Stephen Ellis	Services, August 8 to 15, 1891	10.50
24	10	Noble Ware	Services, July 27 to August 15, 1891	27.00
25	11	W. F. Hillebrand	Traveling expenses	12.30
26	12	Sophie C. Harrison	Services, July, 1891	33.00
26	13	Wm. P. Rust	do	67.50
26	14	S. Ward Soper	Traveling expenses	24.70
26	15	United States Express Co	Freight charges	16.60
27	16	Robert Leitch & Sons	Topographic supplies	3.37
27	17	Jefferson Middleton	Traveling expenses	15.30
29	18	O. C. Marsh	Services, August, 1891	337.00
31	19	H. S. Williams	Services, July 1 to August 31, 1891	252.80
31	20	Wm. M. Fontaine	do	337.00
31	21	Herman Baumgarten	Illustration supplies	7.45
31	22	A. Hermann	Services, July and August, 1891	168.40
31	23	T. A. Bostwick	do	168.40
31	24	F. H. Newell	do	337.00
31	25	M. A. Washburne	do	70.00
31	26	F. Berger	Services, August, 1891	80.00
31	27	L. P. Bush	do	50.00
31	28	A. L. Sullins	do	55.00
31	29	W. H. Utterback	do	90.00
31	30	J. B. Hatcher	do	250.00
31	31	W. H. Burwell	do	65.00
31	32	Sam. H. Scudder	do	210.60
31	33	Ira Sayles	do	117.90
31	34	J. Henry Blake	do	151.60
31	35	T. W. Stanton	Services, July and August, 1891	202.20
31	36	Margaret Latimer	Services, August, 1891	50.00
31	37	Emil Greiner	Laboratory supplies	22.25
31	38	C. C. Willard	Rent of offices	266.66
31	39	Pay roll of employés	Services, August, 1891	1,154.00
31	40	do	do	1,086.90
31	41	do	do	980.00
31	42	do	do	856.20
31	43	do	do	1,120.80
31	44	do	do	1,171.40
31	45	do	do	1,145.10

Abstract of disbursements made by Jno. D. McChesney, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Aug. 31	46	Pay roll of employés	Services, August, 1891	$673.90
31	47	E. E. Jackson & Co	Supplies	53.12
		Total		11,922.63
Sept. 2	1	T. W. Stanton	Traveling expenses	245.42
2	2	Chas. D. Walcott	do	62.93
5	3	C. B. Boyle	Services, August, 1891	40.00
5	4	J. L. Ridgway	Traveling expenses	8.25
5	5	Noble Ware	Services, August 17 to September 5, 1891.	27.00
8	6	Lavinia J. Hingston	Services, August 26 to September 7, 1891.	27.50
8	7	Washington Gas Light Co	Laboratory supplies	35.75
8	8	E. W. Parker	Traveling expenses	158.60
8	9	Chicago and Alton R. R. Co	Transportation of assistants	46.25
8	10	Chesapeake and Ohio R. R. Co	do	27.00
8	11	New York, New Haven and Hartford R. R.	do	49.90
8	12	Pennsylvania R. R. Co	do	35.68
15	13	E. J. Pullman	Supplies	97.29
15	14	Baker & Adamson	Laboratory supplies	32.83
11	15	James G. Bowen	Care and forage of public animals	24.00
11	16	Victoria Essex	Services, August, 1891	50.00
11	17	Mary C. Mahon	Services, August 5–31, 1891	36.00
14	18	Julius Bien & Co	100 copies of map of North America	23.00
14	19	Hubbell, Merwin & Co	Paleontologic supplies	56.45
14	20	Adams Express Co	Freight, July, 1891	105.45
16	21	Baltimore and Ohio R. R	Transportation of assistants	141.60
16	22	Chas. Bogan	Services, August 1-19, 1891	30.98
16	23	Wyckoff, Seamans & Benedict	Repairs	3.25
18	24	Chas. C. Potts	Publications	3.60
19	25	Shepherd & Hurley	Supplies	26.00
19	26	Wm. D. Clark & Co	do	104.55
19	27	Noble Ware	Services, September 7–16, 1891	13.50
19	28	Alfred Moten	Services, September 15–19, 1891	6.66
21	29	Z. D. Gilman	Supplies	206.99
19	30	Pennsylvania R. R. Co	Transportation of assistants	14.54
19	31	F. W. Sardeson	Services, July 15 to August 26, 1891	129.50
21	32	Mary C. Mahon	Services, September 1–14, 1891	23.00
22	33	Jefferson Middleton	Traveling expenses	81.10
26	34	David T. Day	do	14.65
29	35	Sam H. Scudder	Services, September, 1891	203.80
30	36	Alpheus Hyatt	Services, August and September, 1891.	331.50
30	37	Ira Sayles	Services, September, 1891	114.20
30	38	J. Henry Blake	do	146.80
30	39	O. C. Marsh	do	326.00
30	40	A. L. Sullins	do	55.00
30	41	W. H. Utterback	do	90.00
30	42	W. A. Washburne	do	35.00
30	43	F. Berger	do	80.00
30	44	T. A. Bostwick	do	81.60
30	45	L. P. Bush	do	50.00
30	46	J. B. Hatcher	do	250.00
30	47	A. Hermann	do	81.60
30	48	W. H. Burwell	Services, September 1 to 15, 1891	32.50
30	49	Louis Cook	Services, September 15 to 30, 1891	27.50
30	50	S. Ward Loper	Services, July 27 to 31, 1891	7.25
30	51	do	Services, August, 1891	75.00
30	52	do	Traveling expenses	381.55
30	53	C. C. Willard	Rent of offices	266.66
30	54	C. B. Boyle	Services, September, 1891	40.00
30	55	F. H. Knowlton	do	114.20
30	56	Pay-roll of employés	do	1,117.00
30	57	do	do	1,024.80
30	58	do	do	950.00
30	59	do	do	881.60
30	60	do	do	1,072.00
30	61	do	do	1,137.20
30	62	do	do	1,109.80
30	63	do	do	652.20
30	64	Z. D. Gilman	Laboratory supplies	31.19
		Total		12,754.57
Oct. 3	1	Louvenia Russell	Services, September, 1891	66.00
3	2	Victoria Essex	do	52.00

Abstract of disbursements made by Jno. D. McChesney, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
Oct. 6	3	Wm. M. Fontaine	Services, September, 1891	$163.00
6	4	Harriet Biddle	Services, July 1 to September 30, 1891.	30.00
6	5	Wm. Grunow, jr	Laboratory supplies	227.38
6	6	Washington Gas Light Co	......do	35.75
6	7	Springmann & Bro	Hauling books	6.00
6	8	Geo. W. Knox	Freight charges and hauling	26.14
6	9	Wash. B. Williams	Mineral resource supplies	4.50
7	10	Wm. P. Rust	Services, August 17 to September 30, 1891.	136.50
6	11	John C. Parker	Supplies	13.25
8	12	Chicago and Northwestern Rwy. Co.	Transportation of assistants	12.69
8	13	Denver and Rio Grande Rwy. Co.	......do	10.60
8	14	Darling, Brown & Sharpe	Topographic supplies	9.00
9	15	Baltimore & Ohio R. R. Co	Transportation of assistants	36.75
9	16	Richmond & Danville R. R. Co	......do	21.85
9	17	Rio Grande Western Rwy	......do	51.00
9	18	St. Louis and San Francisco R. R	......do	11.75
9	19	James G. Bowen	Care and forage of public animals	23.25
9	20	Geo. Ryneal, jr	Supplies	222.17
9	21	H. V. Rothery	Services, September 28 to October 9, 1891.	16.50
10	22	Robert Beall	Publications	16.00
13	23	Chas. G. Stott & Co	Topographic supplies	10.95
13	24	N. Y. Central and Hudson River R. R.	Transportation of assistant	11.50
13	25	Rio Grande Western Rwy. Co	......do	16.50
13	26	Adams Express Co	Freight charges, August, 1891	74.70
13	27	United States Express Co	......do	11.55
13	28	Marcus Baker	Traveling expenses	22.00
20	29	Royce and Marean	Geologic supplies	3.10
15	30	Mecan & Co	Geologic repairs	21.16
20	31	John M. Gurley	Services, September 2 to 30, 1891	50.00
20	32	S. Ward Loper	Services, September, 1891	75.00
20	33	Geo. H. Walker & Co	Publications	15.00
20	34	John C. Entriken	Repairs to laboratory	18.99
20	35	David T. Day	Traveling expenses	47.70
21	36	W. & L. E. Gurley	Topographic supplies	8.50
21	37	Wyckoff, Seamans & Benedict	Supplies and repairs	18.53
21	38	Geo. Ryneal, jr	Supplies	101.67
21	39	G. K. Gilbert	Publications	4.50
24	40	U. S. Express Co	Freight charges	7.75
21	41	L. H. Schneider's Sons	Laboratory material	144.06
21	42	......do	Topographic supplies	4.05
21	43	James K. Cleary	......do	4.50
22	44	Fayette R. Plumb	Geologic supplies	136.35
21	45	Marcus Baker	Traveling expenses	40.40
22	46	Andrew Renz	Geologic supplies	11.50
26	47	Z. D. Gilman	Supplies	147.53
26	48	Wabash R. R. Co	Transportation of assistant	14.20
28	49	B. P. Murray	Laboratory supplies	7.50
28	50	Peoples Dispatch and Transfer Co.	Freight charges and hauling	1.48
27	51	John H. Jones	Services, August 17 to September 30, 1891.	150.09
28	52	Denver and Rio Grande R. R. Co	Transportation of assistant	12.85
29	53	Wm. Grunow	Laboratory supplies	25.00
29	54	Melville Lindsay	Supplies	25.93
29	55	S. Ward Loper	Traveling expenses	32.45
31	56	O. C. Marsh	Services, October, 1891	337.00
31	57	L. P. Bush	......do	50.00
31	58	F. Berger	......do	80.00
31	59	J. B. Hatcher	......do	250.00
31	60	A. L. Sullins	......do	55.00
31	61	W. H. Utterback	......do	90.00
31	62	Louis Cook	......do	55.00
31	63	R. W. Westbrook	......do	70.00
31	64	Robert T. Hill	......do	350.00
31	65	Ira Sayles	......do	117.90
31	66	Wm. M. Fontaine	......do	168.50
31	67	J. Henry Blake	......do	151.60
31	68	Gilbert D. Harris	......do	84.20
31	69	Alpheus Hyatt	......do	168.50
31	70	C. B. Boyle	......do	40.00
31	71	Payroll of employés	......do	1,154.00
31	72	......do	......do	1,110.44

Abstract of disbursements made by Jno. D. McChesney, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Oct. 31	73	Pay roll of employés	Services, October, 1891	$980.00
31	74	......do	......do	654.00
31	75	......do	......do	1,019.80
31	76	......do	......do	1,171.40
31	77	......do	......do	1,145.10
31	78	......do	......do	673.90
31	79	C. C. Willard	Rent of offices	266.66
		Total		12,721.98
Nov. 6	1	Victoria Essex	Services, October 1891	54.00
6	2	Louvenia Russell	......do	54.00
7	3	Chas. D. Walcott	Traveling expenses	165.32
6	4	T. W. Stanton	Field expenses	10.00
7	5	Sam. H. Scudder	Services, October, 1891	210.60
7	6	W. Zinsser & Co	Geologic supplies	4.70
7	7	Baker & Adamson	Laboratory supplies	23.05
7	8	Baltimore & Ohio R. R. Co	Transportation of assistants	82.80
7	9	John C. Parker	Mineral resource supplies	.75
10	10	......do	......do	6.50
9	11	Chas. G. Stott & Co	Supplies	25.27
10	12	Wm. C. Day	Services	250.00
10	13	S. Ward Loper	Services, October, 1891	75.00
10	14	......do	Traveling expenses	54.25
10	15	Eimer & Amend	Laboratory supplies	202.11
10	16	Washington Gas-Light Co	......do	50.25
10	17	James G. Bowen	Care and forage of public animals	22.50
10	18	E. J. Pullman	Supplies	176.12
11	19	Chas. R. Keys	Original drawings	57.50
11	20	Columbia Phonograph Co	Rent of phonographs	42.50
11	21	Buffalo Dental M'f'g Co	Laboratory material	12.00
11	22	Pennsylvania Company	Transportation of assistants	35.00
11	23	Independent Ice Co	Laboratory supplies	.76
11	24	Robert Leitch & Son	Topographic supplies	.68
16	25	C. D. White	Traveling expenses	45.65
17	26	Northern Pacific R. R. Co	Transportation of assistants	33.25
17	27	Pennsylvania R. R. Co	......do	155.50
17	28	......do	Transportation of property	.84
17	29	J. S. Topham	Supplies	10.00
17	30	Geo. Ryneal, jr	......do	62.33
17	31	E. J. Harman	Repairs	7.25
17	32	F. H. Knowlton	Services, October 29 to 31, 1891	11.41
17	33	Adams Express Co	Freight charges	55.45
18	34	Melville Lindsay	Laboratory supplies	7.20
18	35	Henry S. Williams	Services, Sept. and October, 1891	248.60
18	36	Geo. H. D. L'Amoreux	Services, July 1-13, 1891	20.00
20	37	J. W. Powell	Traveling expenses	78.25
20	38	U. S. Express Co	Freight charges	66.50
20	39	E. E. Jackson & Co	Geologic supplies	107.94
23	40	The Pittsburg Reduction Co	Laboratory supplies	7.00
23	41	Wm. Kerr	......do	17.00
23	42	L. H. Schneider's Son	Supplies	67.45
25	43	J. W. Harvey	Services, Oct. 11 to Nov. 6, 1891	51.00
25	44	Northern Pacific R. R. Co	Transportation of assistants	122.50
25	45	St. Louis and San Francisco R. R. Co.	......do	8.40
25	46	Pennsylvania R. R. Co	Transportation of property	1.91
25	47	......do	......do	3.73
28	48	Jas. G. Bowen	Livery and transportation	38.60
28	49	Ira Sayles	Services, November, 1891	114.20
30	50	Alpheus Hyatt	......do	163.00
30	51	Sam. H. Scudder	......do	203.80
30	52	Wm. M. Fontaine	......do	163.00
30	53	J. Henry Blake	......do	146.80
30	54	Henry Buford	Services, November 2 to 16, 1891	26.00
30	55	O. C. Marsh	Services, November, 1891	326.00
30	56	F. Berger	......do	80.00
30	57	L. P. Bush	......do	50.00
30	58	Louis Cook	......do	55.00
30	59	A. L. Sullins	......do	55.00
30	60	J. B. Hatcher	......do	250.00
30	61	A. E. Burrell	......do	55.00
30	62	C. B. Boyle	......do	40.00
30	63	Louvenia Russell	......do	48.00
30	64	Victoria Essex	......do	48.00
30	65	W. D. Doremus	Hand stamps and repairs	7.25
30	66	Frank Burns	Services, November, 1891	50.00
30	67	Pay roll of employés	......do	1,117.00

Abstract of disbursements made by Jno. D. McChesney, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Nov. 30	68	Pay roll of employés	Services, November, 1891	$1,450.80
30	69	......do	......do	1,138.60
30	70	......do	......do	950.00
30	71	......do	......do	766.85
30	72	......do	......do	1,620.00
30	73	......do	......do	1,054.60
30	74	......do	......do	1,063.77
30	75	......do	......do	1,106.57
30	76	......do	......do	652.20
30	77	Lester F. Ward	Traveling expenses	637.75
30	78	Cooper Curtice	Services, November 16 to 30, 1891	75.00
30	79	R. W. Westbrook	Services, November, 1891	70.00
30	80	C. C. Willard	Rent of rooms	266.66
		Total		16,694.27
Dec. 4	1	Frank Burns	Traveling expenses	41.95
4	2	......do	......do	33.67
4	3	C. A. White	......do	100.07
5	4	Geo. W. Knox	Freight charges and hauling	86.34
5	5	Washington Gas Light Co	Laboratory supplies	56.75
5	6	Easton & Rupp	Supplies	9.15
5	7	H. H. Hall	Supplies for mineral resources	5.00
5	8	Sawin's Express	Freight charges	20.41
5	9	Burlington and Missouri River R. R. in Nebraska.	Transportation of assistants	45.05
8	10	Baltimore and Ohio R. R.	......do	45.15
8	11	......do	Transportation of property	.84
8	12	......do	......do	.84
8	13	Northern Pacific R. R	Transportation of assistants	48.50
8	14	S. Ward Loper	Services, November, 1891	75.00
5	15	James G. Bowen	Care and forage of public animals	54.50
12	16	Gilbert D. Harris	Services, November, 1891	81.60
12	17	Charles R. Keyes	Services, July 1 to August 21, 1891	180.00
12	18	Shepherd & Hurley	Services and materials	13.91
15	19	David T. Day	Traveling expenses	24.68
17	20	Charles S. Prosser	......do	128.91
17	21	E. Morrison Paper Co	Geologic supplies	2.70
17	22	Henry A. Clarke & Son	......do	20.00
17	23	John C. Parker	Supplies	5.20
17	24	Henry Bower	Services, November 15 to 30, 1891	25.00
17	25	People's Dispatch and Transfer Co.	Freight charges and hauling	4.31
17	26	Hall & Sons	Laboratory supplies	21.45
17	27	S. Ward Loper	Traveling expenses	74.95
17	28	The John Ryan Co	Geologic supplies	3.00
17	29	H. H. Ballard	Laboratory supplies	10.00
17	30	N. V. Randolph & Co	Paleontologic supplies	5.25
18	31	Geo. Ryneal, jr	Supplies	33.85
18	32	M. W. Beveridge	......do	11.65
19	33	E. H. King	......do	8.00
19	34	Fred A. Schmidt	......do	12.46
19	35	People's Dispatch and Transfer Co.	Freight charges	2.09
23	36	Delancey W. Gill	Traveling expenses	11.75
23	37	Mary C. Mahon	Services, December 7 to 19, 1891	18.00
23	38	Wm. P. Rust	Services, October 1 to 16, 1891	55.25
23	39	Z. D. Gilman	Supplies	230.46
24	40	Pennsylvania R. R. Co	Transportation of property	3.65
24	41	E. J. Pullman	Illustration supplies	38.32
24	42	James W. Queen & Co	Laboratory supplies	11.56
24	43	L. H. Schneider's Son	Supplies	27.60
24	44	Hermann Baumgarten	......do	11.75
28	45	Royce & Marean	Illustration supplies	12.03
28	46	W. & L. E. Gurley	Topographic supplies	8.75
28	47	Denver and Rio Grande Rwy. Co.	Transportation of assistant	25.00
28	48	Chicago, Milwaukee and St. Paul Ry.	......do	29.00
28	49	Southern California R. R.	......do	5.00
28	50	McNab & Harlan Mf'g Co	Laboratory supplies	29.75
28	51	The Harrison Safety Boiler Works.	......do	10.00
28	52	Frederic Robbins & Co	......do	4.00
28	53	Charles R. Keyes	Traveling expenses	129.78
29	54	David T. Day	......do	11.23
31	55	Pennsylvania R. R. Co	Transportation of property	3.25
31	56	Henry J. Green	Topographic supplies	487.50
31	57	Burlington and Missouri River R. R. in Nebraska	Transportation of assistants	89.80

Abstract of disbursements made by Jno. D. McChesney, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Dec. 31	58	O. C. Marsh	Services, December, 1891	$337.00
31	59	R. W. Westbrook	do	70.00
31	60	F. Berger	do	80.00
31	61	L. P. Bush	do	65.00
31	62	J. B. Hatcher	do	250.00
31	63	Louis Cook	do	55.00
31	64	A. E. Burrell	do	55.00
31	65	A. E. Sullins	do	55.00
31	66	A. Hermann	Services, October 1 to Dec. 31, 1891	250.00
31	67	T. A. Bostwick	do	250.00
31	68	Alpheus Hyatt	Services, December, 1891	168.50
31	69	Ira Sayles	do	117.90
31	70	J. Henry Blake	do	151.60
31	71	Wm. M. Fontaine	do	168.50
31	72	Sam. H. Scudder	do	210.60
31	73	Harriet, Biddle	Services, October 1 to Dec. 31, 1891	30.00
31	74	F. H. Newell	Services, December 6 to 31, 1891	141.30
31	75	C. B. Boyle	Services, December, 1891	40.00
31	76	C. C. Willard	Rent of rooms	266.66
31	77	Pay roll of employés	Services, December, 1891	1,154.00
31	78	do	do	1,165.70
31	79	do	do	980.00
31	80	do	do	956.70
31	81	do	do	1,137.70
31	82	do	do	1,019.80
31	83	do	do	1,145.10
31	84	do	do	673.90
31	85	N. S. Shaler	do	270.00
		Total		13,811.22
1892.				
Jan. 6	1	Cooper Curtice	Services, December 1 to 26, 1891	125.81
7	2	Geo. Ryneal, jr	Topographic supplies	30.10
7	3	Chas. G. Stott & Co	Illustration supplies	9.50
7	4	Stephenson's Express	Freight charges and hauling	1.75
7	5	Washington Gas Light Co	Laboratory supplies	62.25
7	6	Denver & Rio Grande Rwy. Co	Transportation of assistants	25.70
7	7	E. E. Jackson & Co	Supplies	120.84
7	8	United States Express Co	Freight charges	149.41
7	9	do	do	2.90
8	10	Chas. C. Darwin	Traveling expenses	270.95
11	11	Wisconsin Central Lines	Transportation of assistants	29.50
9	12	L. W. Sherman	Mineral resource supplies	3.00
11	13	Wm. D. Clark & Co	Supplies	3.88
11	14	John C. Parker	Geologic supplies	1.75
11	15	Columbia Phonograph Co	Rent of phonographs, etc	42.75
11	16	James G. Bowen	Care and forage of public animals	22.50
11	17	do	Care and forage of public animals, etc.	38.50
13	18	Rio Grande Western Rwy. Co	Transportation of assistants	25.00
13	19	Denver and Rio Grande Western Rwy.	do	22.40
13	20	James W. Queen & Co	Laboratory supplies	26.25
13	21	Belt & Dyer	Topographic supplies	43.00
13	22	Baker & Adamson	Laboratory supplies	21.28
13	23	Wm. H. Dall	Traveling expenses	21.08
13	24	Robert Boyd	Supplies	27.22
13	25	Atchison, Topeka and Santa Fé R. R.	Transportation of assistants	147.40
14	26	Northern Pacific R. R. Co	do	39.50
14	27	Baltimore and Ohio R. R. Co	do	19.15
14	28	Wash. B. Williams	Geologic supplies	42.00
14	29	A. H. Storer	Supplies for mineral resources	9.00
14	30	Gustav E. Stechert	Topographic supplies	1.25
15	31	Chas. D. Walcott	Traveling expenses	46.56
15	32	Melville Lindsay	Topographic supplies	1.80
15	33	J. W. Harvey	Freight charges	15.19
15	34	Southern Pacific Co	Topographic supplies	3.20
15	35	W. H. Morrison	Publications	115.25
21	36	Richmond and Danville R. R. Co.	Transportation of assistants	45.50
21	37	Louisville and Nashville R. R. Co.	do	53.00
21	38	National Press Intelligence Co.	Newspaper clippings	25.30
21	39	N. D. C. Hodges	Publications	7.00
21	40	W. Andrew Boyd	do	25.00
21	41	John Birkenbine	Services, August 17 to December 31, 1891.	250.00

Abstract of disbursements made by Jno. D. McChesney, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
Jan. 21	42	Richards & Co., Limited	Laboratory supplies	$7.11
21	43	E. J. Pullman	Supplies	14.30
21	44	L. H. Schneider's Son	do	9.10
22	45	Emil Greiner	Laboratory supplies	48.46
22	46	Adams & McKown	do	1.55
22	47	W. W. Mildrum	Topographic supplies	6.00
22	48	Burlington and Missouri R. R. in Nebraska.	Transportation of assistants	44.90
22	49	Southern California R. R	Transportation of property	4.49
23	50	W. D. Castle	Geologic supplies	26.00
25	51	Colorado Midland R. R. Co	Transportation of assistants	18.00
25	52	Atlantic & Pacific R. R. Co	do	41.30
25	53	American Carbonate Co	Laboratory supplies	2.85
25	54	Eimer & Amend	do	351.39
25	55	F. Jay Haynes & Bro	Illustration supplies	6.00
25	56	M. A. Tappan	Geologic supplies	42.00
30	57	O. C. Marsh	Services, January, 1892	340.70
30	58	R. W. Westbrook	do	70.00
30	59	L. P. Bush	do	65.00
30	60	F. Berger	do	80.00
30	61	J. B. Hatcher	do	250.00
30	62	A. L. Sullins	Services, January 1 to 15, 1892	55.00
30	63	A. L. Burrell	do	26.60
30	64	Louis Cook	Services, January, 1892	26.60
30	65	Wm. F. Porter	Publications	7.00
30	66	Adams Express Co	Express charges	714.90
30	67	H. S. Williams	Services, November and December, 1891.	248.60
30	68	Alpheus Hyatt	Services, January, 1892	170.30
30	69	J. Henry Blake	do	153.30
30	70	Samuuel H. Scudder	do	212.90
30	71	Ira Sayles	do	119.20
30	72	Pennsylvania R. R. Co	Transportation of property	1.61
30	73	Denver & Rio Grande Rwy. Co.	Transportation of assistants	17.80
30	74	Wash. B. Williams	Geologic supplies	4.50
30	75	C. C. Willard	Rent of office rooms	266.66
30	76	Cooper Curtice	Services, January, 1892	150.00
30	77	C. B. Boyle	do	40.00
30	78	Pay roll of employés	do	1,166.70
30	79	do	do	1,195.96
30	80	do	do	990.30
30	81	do	do	1,329.20
30	82	do	do	1,149.00
30	83	do	do	1,080.80
30	84	do	do	1,157.10
30	85	do	do	681.30
		Total		14,367.90
Feb. 1	1	Robert Beall	Publications	110.25
5	2	James G. Bowen	Care and forage of public animals	55.00
5	3	Louvenia Russell	Services, December 6, 1891, to January 30, 1892.	45.00
5	4	S. N. Tucker	Repairs to geologic supplies	2.00
5	5	H. Hoffa	Paleontologic supplies	6.95
6	6	G. D. Harris	Services, December 1, 1891, to January 31, 1892.	169.40
6	7	W. & L. F. Gurley	Topographic supplies	12.00
6	8	Wm. D. Clark & Co	Supplies	10.19
6	9	Washington Gas Light Co	Laboratory supplies	62.00
8	10	Smithsonian Institution	Transportation of exchanges	962.57
8	11	Jas. D. & E. S. Dana	Publications	6.00
9	12	Baltimore & Ohio R. R. Co	Transportation of assistant	10.00
8	13	W. D. Doremus	Supplies	10.00
9	14	L. H. Schneider's Son	do	37.07
11	15	J. W. Lambreth	Services, January 25–30, 1892	12.00
11	16	Jos. F. Sabin	Publications	4.00
11	17	E. F. Brooks	Geologic supplies	19.35
11	18	Z. D. Gilman	Laboratory supplies	38.32
11	19	do	Supplies	170.50
11	20	John C. Parker	do	12.40
15	21	E. J. Lewis	Paleontologic supplies	12.45
15	22	Baker & Adamson	Laboratory supplies	32.83
15	23	Jas. W. Queen & Co	do	30.30
15	24	Richards & Co., Limited	do	83.79
15	25	Cutter & Wood	Geologic supplies	16.87
15	26	R. R. Bowker	Publications	7.00
15	27	Wyckoff, Seamans & Benedict	Repairs and supplies	8.26

Abstract of disbursements made by Jno. D. McChesney, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
Feb. 15	28	Helen B. Weir	Services, February 1-6, 1892	$12.00
16	29	Thos. C. Basshor & Co	Laboratory supplies	2.58
16	30	L. H. Schneider's Son	Supplies	65.53
18	31	Geo. Ryneal, jr	do	326.65
18	32	W. D. Doremus	Supplies and repairs	17.75
18	33	Chicago, Rock Island & Pacific R. R.	Transportation of assistants	144.77
18	34	E. E. Jackson & Co	Supplies	45.52
18	35	do	do	113.49
20	36	The Eastman Company	do	5.61
20	37	Emil Greiner	Laboratory supplies	7.65
20	38	Gustav E. Stechert	Publications	212.89
23	39	Wm. A. Raborg	Traveling expenses	10.75
24	40	Whitall, Tatum & Co	Laboratory supplies	39.57
24	41	Bertha Zinc Co	do	8.50
24	42	Henry Buford	Services, February 1 to 13, 1892	24.00
24	43	J. W. Harvey	Freight charges	5.64
24	44	Denver & Rio Grande Rwy. Co	do	2.43
25	45	Eimer & Amend	Laboratory supplies	28.12
25	46	J. W. Harvey	Services, November 7 to December 30, 1891.	60.00
26	47	Geo. W. Knox	Freight charges and hauling	67.34
26	48	Cooke & Co	Geologic supplies	8.05
26	49	Atchison, Topeka & Santa Fé R. R.	Transportation of assistants	37.70
27	50	People's Dispatch & Transfer Co	Freight charges and hauling	26.24
29	51	Alpheus Hyatt	Services, February, 1892	159.40
29	52	J. Henry Blake	do	143.40
29	53	Sam. H. Scudder	do	199.20
29	54	O. C. Marsh	do	318.60
29	55	J. B. Hatcher	do	200.00
29	56	L. P. Bush	do	65.00
29	57	F. Berger	do	80.00
29	58	John C. Parker	Mineral resource supplies	225.74
29	59	Cooper Curtice	Services, February, 1892	150.00
29	60	Ira Sayles	do	111.60
29	61	C. B. Boyle	do	40.00
29	62	Pay roll of employés	do	1,091.60
29	63	do	do	1,179.20
29	64	do	do	929.40
29	65	do	do	1,212.60
29	66	do	do	1,161.60
29	67	do	do	1,018.40
29	68	do	do	1,085.80
29	69	do	do	525.80
29	70	Louvenia Russell	do	36.00
29	71	Chas. G. Stott & Co	Supplies	21.45
29	72	E. E. Jackson & Co	do	197.40
		Total		13,371.48
Mar. 4	1	John J. Germond	Services, January 1 to 11, 1892	17.74
5	2	Robert Beall	Publications	59.05
5	3	Z. D. Gilman	Supplies	246.10
5	4	James G. Bowen	Care and forage of public animals	50.50
5	5	C. C. Willard	Rent of offices. February, 1892	266.66
7	6	Southern Pacific Co	Transportation of assistants	136.40
7	7	Eimer & Amend	Laboratory supplies	105.33
7	8	Buffalo Dental Manufacturing Co.	do	15.00
7	9	Washington Gas Light Co	do	67.50
7	10	Charles J. Cohen	Geologic supplies	17.20
9	11	E. E. Jackson & Co	Supplies	28.00
9	12	James W. Queen & Co	do	25.93
9	13	William B. Clark	Services, February 6 to 29, 1892	100.00
9	14	Baltimore and Ohio R. R. Co	Freight charges	1.30
10	15	E. J. Pullman	Supplies	275.07
10	16	James K. Cleary	do	60
10	17	do	do	1.75
10	18	George W. Knox	Freight charges and hauling	20.03
16	19	Pennsylvania R. R. Co	Transportaton of assistants	40.15
16	20	Rand, McNally & Co	Publications	18.00
16	21	John C. Parker	Mineral resources and supplies	2.35
16	22	William D. Clark & Co	Geologic supplies	30
16	23	Melville Lindsay	do	2.45
16	24	Eimer & Amend	Laboratory material	5.60
16	25	U. S. Express Co	Freight charges	41.35
19	26	Thomas Somerville & Sons	Illustration supplies	2.81

Abstract of disbursements made by Jno. D. McChesney, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
Mar. 19	27	W. H. Lowdermilk & Co	Publications	$42.80
19	28	Wash. B. Williams	Supplies	41.50
21	29	Melville Lindsey	do	1.50
23	30	Stephenson's Express	Freight charges and hauling	11.35
23	31	George W. Knox	do	20.39
24	32	Brentanos	Publications	1.00
24	33	Charles G. Stott & Co	Supplies	4.40
24	34	E. F. Brooks	do	75
25	35	Hubbard Bros	Publications	28.00
30	36	Andrew Renz	Grinding 5 hammers	75
31	37	Cooper Curtice	Services, March, 1892	150.00
31	38	Samuel H. Scudder	do	212.90
31	39	J. Henry Blake	do	153.30
31	40	Harriet Biddle	Services, Jan. 1 to Mar. 31, 1892	30.00
31	41	A. Hermann	do	250.00
31	42	T. A. Bostwick	do	250.00
31	43	J. B. Hatcher	Services, March, 1892	250.00
31	44	O. C. Marsh	do	340.70
31	45	A. E. Burrell	do	55.00
31	46	A. L. Sullins	do	60.00
31	47	L. Cook	do	55.00
31	48	L. P. Bush	do	65.00
31	49	David T. Day	Traveling expenses	24.90
31	50	C. C. Willard	Rent of office rooms, March, 1892	266.66
31	51	Pennsylvania R. R. Co	Freight charges	1.15
31	52	Chicago, Milwaukee and St. Paul Rwy.	do	1.38
31	53	Wm. Zinsser & Co	Supplies	4.70
31	54	Northern Pacific R. R. Co	Transportation of assistant	15.85
31	55	Ira Sayles	Services, March, 1892	119.20
31	56	C. B. Boyle	do	40.00
31	57	Pay roll of employés	do	1,166.70
31	58	do	do	1,237.90
31	59	do	do	990.30
31	60	do	do	1,281.20
31	61	do	do	1,234.20
31	62	do	do	1,080.80
31	63	do	do	1,259.30
31	64	do	do	562.10
31	65	Washington Gas-Light Co	Laboratory supplies	64.25
				12,922.05
Apr. 2	1	M. L. Ferguson	Publications	10.00
4	2	Robert Beall	do	87.40
4	3	Louvenia Russell	Services, March, 1892	40.50
5	4	Wm. H. Dall	Traveling expenses	7.00
5	5	James B. Lambie	Geologic supplies	2.75
7	6	Wyckoff, Seamans & Benedict	Repairs	41.77
7	7	William B. Clark	Services, March, 1892	125.00
7	8	Richmond and Danville R. R. Co	Transportation of assistant	20.30
7	9	Texas and Pacific R. R. Co	do	15.30
7	10	James G. Bowen	Care and forage of public animals, etc.	52.00
7	11	B. P. Murray	Laboratory supplies	7.50
7	12	Cutter & Wood	Geologic supplies	14.80
7	13	Columbia Phonograph Co	Rent of phonographs	42.50
7	14	F. Berger	Services, March, 1892	80.00
13	15	S. Ward Loper	Field expenses	7.00
13	16	J. E. Hurley	Repairs	12.00
13	17	Pennsylvania R. R. Co	Transportation of assistants	138.60
13	18	Alpheus Hyatt	Services, March, 1892	170.30
15	19	L. H. Schneider's Son	Supplies	22.83
15	20	E. J. Pullman	do	16.74
15	21	Buffalo Dental Manufacturing Co	Laboratory supplies	16.00
16	22	National Press Intelligence Co	Publications	10.90
16	23	Chas. G. Stott & Co	Topographic supplies	35.00
16	24	Robert Leitch & Sons	do	3.82
16	25	Estate of Geo. W. Knox	Freight charges and hauling	6.98
19	26	E. E. Jackson & Co	Supplies	279.05
19	27	People's Dispatch and Transfer Co.	Freight charges and hauling	1.37
21	28	Eimer & Amend	Laboratory supplies	77.71
21	29	Library Bureau	Paleontologic supplies	2.00
27	30	J. S. Topham	Geologic supplies	10.00
27	31	Latimer & Sloan	Publications	10.40
27	32	Stephenson's Express	Freight charges and hauling	4.19
27	33	Baltimore and Ohio R. R. Co	Transportation of assistants	53.15

Abstract of disbursements made by Jno. D. McChesney, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892. Apr. 27	34	Emil Greiner	Laboratory supplies	$6.34
27	35	James W. Queen & Co	do	11.70
27	36	Henry A. Clark & Son	Paleontologic supplies	85.00
29	37	Cooper Curtice	Traveling expenses	132.03
30	38	Alpheus Hyatt	Services, April, 1892	164.80
30	39	H. S. Williams	Services, January 1 to April 30, 1892.	498.60
30	40	J. Henry Blake	Services, April, 1892	148.30
30	41	Sam. H. Scudder	do	206.00
30	42	Cooper Curtice	Services, April 1 to 14, 1892	70.00
30	43	C. B. Boyle	Services, April, 1892	40.00
30	44	O. C. Marsh	do	329.70
30	45	Lewis S. Hayden	Publications	11.25
30	46	James W. Queen & Co	Laboratory repairs and supplies	35.43
30	47	J. S. Topham	Geologic supplies	6.00
30	48	J. H. Lewis	Field expenses	9.00
30	49	Wallace George	do	30.00
30	50	Pennsylvania R. R. Co	Freight charges	5.49
30	51	Robert E. C. Stearns	Services, April, 1892	164.80
30	52	Pay roll of employés	do	1,129.05
30	53	do	do	1,258.10
30	54	do	do	663.30
30	55	do	do	1,082.05
30	56	do	do	1,214.45
30	57	do	do	1,108.80
30	58	do	do	1,170.30
30	59	do	do	543.95
30	60	Louvenia Russell	do	39.00
30	61	Washington Gas Light Co	Laboratory supplies	64.50
30	62	Robert Beall	Publications	73.65
30	63	C. C. Willard	Rent of office rooms, April, 1892	266.66
		Total		11,993.11
May 4	1	James G. Bowen	Care and forage of public animals	45.50
4	2	Wyckoff, Seamans & Benedict	Repairs	5.80
4	3	Chas. G. Stott & Co	Illustration supplies	9.30
6	4	Emil Greiner	Laboratory supplies	7.20
6	5	Melville Lindsay	do	5.00
6	6	do	do	.60
6	7	B. T. A. Bell	Publication	3.00
6	8	Williams, Brown & Earle	Geologic supplies	45.60
6	9	W. E. Owen	Paleontologic supplies	1.50
9	10	United States Express Co	Express charges	30.70
10	11	Baker & Adamson	Laboratory supplies	1.75
10	12	E. J. Pullman	Supplies	116.51
12	13	C. A. White	Traveling expenses	33.95
13	14	Z. D. Gilman	Supplies	138.98
13	15	Lester F. Ward	Traveling expenses	213.36
16	16	The M. Ohmer's Sons Co	Geologic supplies	75.00
16	17	L. H. Schneider's Son	Supplies	38.07
16	18	Eimer & Amend	Laboratory material	90.15
16	19	Pennsylvania R. R. Co	Transportation of assistant	86.50
18	20	L. H. Schneider's Son	Geologic supplies	.72
18	21	Atchison, Topeka and Santa Fé R. R.	Transportation of assistants	45.65
18	22	Peoples' Dispatch and Transfer Co.	Freight charges	2.01
19	23	Chas. G. Stott & Co	Illustration supplies	8.00
19	24	Geo. Ryneal, jr	Supplies	303.71
20	25	Northern Pacific Rwy. Co	Freight charges	7.07
19	26	Adams Express Co	do	162.70
23	27	S. B. Newbury	Services, Dec. 1, 1891, to Jan. 30, 1892	50.00
25	28	B. P. Murray	Laboratory supplies	11.25
27	29	The Northern Distillery Co	Geologic supplies	21.15
27	30	The South Florida Tel. Co	Telegrams, Nov. 1891	.34
27	31	E. W. Parker	Traveling expenses	47.96
28	32	Newman & Son	Repairs to typewriter	6.00
28	33	E. J. Pullman	Geologic supplies	26.08
28	34	E. E. Jackson & Co	Supplies	135.30
31	35	Chas. D. Walcott	Services, May, 1892	255.50
31	36	Robert E. C. Stearns	do	170.40
31	37	W. L. Wilson	Services, May 7 to 31, 1892	48.38
31	38	H. A. Mackey	Services, May 9 to 31, 1892	37.09
31	39	Louvenia Russell	Services, May, 1892	37.50
31	40	Alpheus Hyatt	do	170.40
31	41	William B. Clark	Services April 16 to May 20, 1892	75.00
31	42	O. C. Marsh	Services, May, 1892	340.60

Abstract of disbursements made by Jno. D. McChesney, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
May 31	43	C. B. Boyle	Service, May, 1892	$70.00
31	44	Pay roll of employés	do	1,166.90
31	45	do	do	1,634.17
31	46	do	do	633.40
31	47	do	do	1,110.90
31	48	do	do	885.60
31	49	do	do	1,142.40
31	50	do	do	1,005.00
31	51	do	do	362.10
31	52	Sam. H. Scudder	do	213.00
31	53	J. Henry Blake	do	153.40
31	54	Washington Gas Light Co	Laboratory supplies	65.25
31	55	C. C. Willard	Rent of office	266.66
		Total		11,820.06
June 3	1	Robert Beall	Publications	30.05
4	2	Brentano's	do	2.40
4	3	New York Safety Steam Power Co.	Laboratory supplies	1.95
4	4	Eimer & Amend	Supplies	16.70
4	5	Wm. D. Castle	do	3.50
4	6	James G. Bowen	Care and forage of public animals, etc.	75.15
9	7	Baltimore and Ohio R. R. Co	Transportation of assistants	195.45
11	8	B. P. Murray	Laboratory supplies	6.00
11	9	E. J. Pullman	Geological supplies	24.69
11	10	Z. D. Gilman	Supplies	51.44
6	11	Lewis S. Hayden	Publications	15.00
7	12	U. S. Express Co	Freight charges	6.75
13	13	J. L. Shaw	Publications	6.00
13	14	Pennsylvania R. R. Co	Transportation of assistants	61.00
13	15	Geo. Ryneal, jr	Supplies	100.17
13	16	Fred. A. Schmidt	do	2.70
13	17	Wyckoff, Seamans & Benedict	Repairs	2.53
13	18	W. J. Yaste	Traveling expenses	16.05
14	19	F. W. Clarke	do	21.70
13	20	Adams Express Co	Freight charges	62.81
15	21	Wm. Grunow	Laboratory supplies	45.00
15	22	Stephenson's Express	Freight charges and hauling	2.54
18	23	G. D. Harris	Traveling expenses	30.85
18	24	Mallet & Hodge	Laboratory repairs	7.75
20	25	Sam. H. Scudder	Traveling expenses	74.73
20	26	Frank Burns	do	63.15
21	27	Wm. H. Dall	do	316.55
21	28	Eimer & Amend	Laboratory supplies	16.32
21	29	Baker & Adamson	do	24.40
21	30	H. A. Mackey	Services, June 1 to 15, 1892	25.00
21	31	W. L. Wilson	Services, June 1 to 19, 1892	38.00
25	32	D. E. Roberts	Services, May, 1892	50.00
25	33	The Casino Art Company	Publication	2.09
25	34	S. N. Tucker	Paleontologic supplies	.40
25	35	do	Geological supplies	7.00
25	36	Baltimore and Ohio R. R. Co	Transportation of assistants	67.00
27	37	Wm. P. Clyde & Co	do	25.00
27	38	John S. Leng's Son & Co	Laboratory supplies	5.16
27	39	Buffalo Dental Manufacturing Co.	do	6.60
27	40	Eimer & Amend	do	69.11
28	41	B. P. Murray	do	10.50
28	42	Geo. W. Knox's Express	Freight charges	31.30
28	43	Chas. G. Stott & Co	Illustration supplies	9.30
29	44	G. D. Harris	Traveling expenses	22.75
29	45	Chas. D. Walcott	do	239.39
30	46	Sam. H. Scudder	Services, June, 1892	206.00
30	47	O. C. Marsh	do	329.70
30	48	Alpheus Hyatt	do	164.80
30	49	J. Henry Blake	do	148.30
30	50	C. B. Boyle	do	70.00
30	51	Harriet Biddle	Services, April 1 to June 30, 1892	30.00
30	52	C. C. Willard	Rent of rooms, June, 1892	266.66
30	53	Louvenia Russell	Services, June, 1892	39.00
30	54	A. Hermann	Services, April 1 to June 30, 1892	250.00
30	55	T. A. Bostwick	do	250.00
30	56	Great Northern Railway Line	Transportation of assistants	40.00
30	57	Z. D. Gilman	Supplies	256.33
30	58	do	do	40.84
30	59	Washington Gas Light Co	Laboratory supplies	52.75

Abstract of disbursements made by Jno. D. McChesney, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
June 30	60	Robert E. C. Stearns	Services, June, 1892	$164.80
30	61	Pay roll of employés	do	1,129.05
30	62	do	do	1,630.90
30	63	do	do	544.10
30	64	do	do	1,017.05
30	65	do	do	1,104.45
30	66	do	do	1,108.80
30	67	do	do	972.50
30	68	do	do	412.05
30	69	W. H. Morrison	Publications	30.00
30	70	L. H. Schneider's Sons	Supplies	12.56
30	71	Frank Burns	Traveling expenses	25.25
30	72	James G. Bowen	Care and forage of public animals	55.50
30	73	Robert Beall	Publications	20.00
30	74	Wm. D. Clark & Co	Laboratory supplies	9.38
30	75	Northern Pacific R. R. Co	Transportation of assistants	18.80
30	76	Columbia Phonograph Co	Rent of phonographs	62.50
30	77	Robert E. C. Stearns	Traveling expenses	171.94
		Total		12,525.94

GEOLOGICAL MAPS OF THE UNITED STATES, 1892.

1891.				
July 28	1	Melville Lindsay	Engravers' supplies	$1.62
29	2	John C. Parker	Ink rollers	5.00
31	3	Pay roll of employés	Services, July, 1891	1 343.50
		Total		1,350.12
Aug. 10	1	Frederick A. Schmidt	Gelatine	3.78
10	2	United States Electric Lighting Co.	Services, July, 1891	25.00
26	3	Peoples' Despatch and Transfer Co.	Freight charges	7.99
24	4	Charles A. Lehmann	Services, August 1 to 15, 1891	39.00
31	5	Henry Lindenmeyr	Lithographic paper	29.60
31	6	Ernest Kübel	Electrotyping bassos	43.68
31	7	John Johnson	Services, August 18 to 31, 1891	18.00
31	8	Pay roll of employés	Services, August, 1891	1,331.77
31	9	W. C. Sowder	do	50.50
31	10	E. E. Jackson & Co	Adjustable top for desk	10.50
		Total		1,559.82
Sept. 8	1	United States Electric Lighting Co.	Use of 4-horse power currrent, August, 1891	25.00
14	2	Adams Express Co	Freight	5.70
15	3	N. Y. Steel and Copper Plate Co.	Copper plates	160.65
16	4	Geo. Meier & Co	Sand	5.00
19	5	R. Hoe & Co	Services and material	130.35
21	6	Z. D. Gilman	Engravers' supplies	12.35
30	7	W. C. Sowder	Services, September, 1891	49.00
30	8	Pay roll of employés	do	1,521.07
		Total		1,909.12
Oct. 6	1	Geo. W. Knox	Freight charges and hauling	2.00
7	2	United States Electric Lighting Co.	Use of 4-horse power current	25.00
9	3	Geo. Ryneal, jr	Engravers' supplies	4.38
9	4	J. S. Topham	Repairs	7.50
13	5	Peter Adams Co	Lithographic paper	360.00
13	6	United States Express Co	Freight charges, August, 1891	5.65
13	7	Adams Express Co	do	4.65
14	8	Washington Construction Co	Services	18.07
20	9	Geo. Meier & Co	Lithographic pens	1.00
20	10	Wm. D. Clark & Co	Cotton cloth	39.14
21	11	Geo. Ryneal, jr	Lithographic pens	3.24
26	12	Mount Holly Paper Co	Lithographic paper	1,387.32
26	13	Z. T. Gilman	Engravers' supplies	3.50
31	14	Pay roll of employés	Services, October, 1891	1,809.88
		Total		3,071.33

Abstract of disbursements made by Jno. D. McChesney, etc.—Continued.

GEOLOGICAL MAPS OF THE UNITED STATES, 1892—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892. Nov. 7	1	John C. Parker	Engravers' supplies	$3.25
7	2	E. H. King	Map cases	78.75
17	3	Geo. Ryneal, jr	Engravers' supplies	31.11
17	4	United States Electric Ligting Co.	Use of 4 horse-power current, October, 1891.	25.00
17	5	Oscar Schleichert	Services, August 31, 1891	2.42
17	6	Adams Express Co	Freight charges	7.70
20	7	E. E. Jackson & Co	Engravers' supplies	1.00
23	8	L. H. Schneider's Son	do	2.30
25	9	Wm. D. Clark & Co	do	65.00
30	10	Pay roll of employés	Services, November, 1891	1,708.68
30	11	F. P. May & Co	Engravers' supplies	6.00
		Total		1,931.21
Dec. 12	1	Shepherd & Hurley	Services and material	882.06
14	2	United States Electric Lighting Co.	Use of 4-horse power current, November. 1891.	25.00
14	3	Chas. Hellmuth	Engravers' supplies	19.60
17	4	Chas. G. Stott & Co	do	11.52
18	5	Geo. Ryneal, jr	do	32.35
18	6	M. W. Beveridge	do	1.39
23	7	do	do	3.80
23	8	Z. D. Gilman	do	15.70
24	9	Robert Mayer & Co	Hand press, etc	188.00
24	10	Melville Lindsay	Engravers' supplies	5.92
24	11	do	do	7.03
24	12	E. J. Pullman	do	5.75
28	13	Edward J. Hannan	Services	6.20
28	14	Royce & Marean	Engravers' supplies	18.41
31	15	Crane & Co	do	10.85
31	16	Pay roll of employés	Services, December, 1891	1.812.65
		Total		2,546.23
1892. Jan. 7	1	E. E. Jackson & Co	Engravers' material	12.00
7	2	Milton Bradley Company	Engravers' supplies	26.25
7	3	Charles G. Stott & Co	do	15.00
11	4	United States Electric Lighting Co.	Use of 4 horse power current, December, 1891.	25.00
9	5	L. W. Sherman	Engravers' supplies	3.00
13	6	Robert Boyd	do	5.40
13	7	Ernest Kübel	Services	23.20
13	8	Wash. B. Williams	Engravers' supplies	2.70
14	9	Melville Lindsay	do	1.20
15	10	William H. Gilbert	Services, January 5 to 15, 1892	12.50
21	11	Fuchs & Lang	Engravers' supplies	6.00
21	12	George Meier & Co	do	2.00
23	13	W. D. Castle	Water tank	5.00
25	14	Mount Holly Paper Co	Lithographic paper	197.95
30	15	Adams Express Co	Express charges	2.80
30	16	Henry Lindenmeyr	Lithographic paper	126.22
30	17	George Meier & Co	Engravers' supplies	31.00
30	18	Pay roll of employés	Services, January, 1892	1,829.72
		Total		2,326.94
Feb 6	1	United States Electric Lighting Co.	Use of 4 horse power current, January, 1892.	25.00
6	2	Bernhard Meiners	Engravers' supplies	6.25
8	3	Bureau of Engraving and Printing.	do	12.50
8	4	Robert Mayer & Co	do	12.25
8	5	Fuchs & Lang	Lithographic stones	183.21
11	6	Z. D. Gilman	Engravers' supplies	33.49
11	7	E. F. Brooks	do	2.10
15	8	R. F. Bartle	do	50.00
16	9	L. H. Schneider's Son	do	3.20
18	10	Geo. Ryneal, jr	do	12.30
25	11	Fred. A. Schmidt	do	4.50
25	12	Washington Construction Co	do	1.60
26	13	Geo. W. Knox	Freight charges and hauling	6.35
27	14	People's Dispatch and Transfer Co.	do	.33
29	15	Pay roll of employés	Services February, 1892	1,758.02
29	16	Chas. G. Stott & Co	Engravers' supplies	4.90
29	17	United States Electric Lighting Co.	Use of 4 horse power current, February, 1892.	25.00
		Total		2,091.00

Abstract of disbursements made by Jno. D. McChesney, etc.—Continued.

GEOLOGICAL MAPS OF THE UNITED STATES, 1892—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
Mar. 5	1	Z. D. Gilman	Engravers' supplies	$3.75
7	2	S. N. Tucker	Repairs to rubber stamp	1.50
9	3	E. E. Jackson & Co	Engravers' supplies	5.68
10	4	James K. Cleary	do	1.20
10	5	do	do	2.00
10	6	Geo. W. Knox	Freight charges and hauling	4.46
11	7	Geo. Meier & Co	Engravers' supplies	5.00
16	8	Wm. D. Clark & Co	do	115.96
16	9	United States Express Co	Freight charges	4.95
19	10	Henry Lindenmeyr & Sons	Engravers' supplies	51.97
19	11	Jas. L. Kervand	do	4.50
21	12	Milton Bradley Company	do	32.81
21	13	Geo. Meier & Co	do	5.00
24	14	R. Hoe & Co	do	1.00
24	15	Chas. G. Stott & Co	do	4.15
31	16	Ernest Kübel	Copper plates	139.50
31	17	Pay roll of employés	Services March, 1892	1,850.91
		Total		2,234.34
Apr. 7	1	United States Electric Lighting Co.	Use of 4 horse power current, March, 1892.	25.00
13	2	Bulkley, Ward & Co	Engravers' supplies	6.20
13	3	J. E. Hurley	Repairs to lithograph press	1.25
15	4	Chas. Hellmuth	Engravers' supplies	13.75
15	5	L. H. Schneider's Son	do	4.35
16	6	Estate of Geo. W. Knox	Freight charges and hauling	2.72
19	7	People's Dispatch and Transfer Co.	do	.75
19	8	M. W. Beveridge	Engravers' supplies	8.00
19	9	E. E. Jackson & Co	do	3.00
19	10	Henry Lindenmeyr	do	74.25
19	11	Washington Construction Co	do	1.20
16	12	James Talty	Services and materials	17.47
20	13	Ernest Kübel	Resurfacing copper plates	166.09
27	14	S. J. Kübel	Traveling expenses	53.00
30	15	Geo. Meier & Co	Engravers' supplies	54.00
30	16	Pay roll of employés	Services, April, 1892	1,889.20
		Total		2,320.23
May 6	1	United States Electric Lighting Co.	Use of 4 horse power current, April, 1892.	25.00
9	2	United States Express Co	Freight charges	2.00
10	3	James K. Cleary	Engravers' supplies	2.00
10	4	William D. Clark & Co	do	62.00
12	5	E. F. Brooks	do	1.30
12	6	George Meier & Co	Lithographic stones	172.65
13	7	Z. D. Gilman	Engravers' supplies	31.15
13	8	Bureau of Engraving and Printing.	do	17.65
16	9	The M. Ohmer's Son's Co	do	230.00
18	10	L. H. Schneider's Son	do	2.05
18	11	People's Dispatch and Transfer Co.	Freight charges	5.65
19	12	Charles G. Stott & Co	Pasteboard tubes	33.00
19	13	George Ryneal, jr	Engravers' supplies	86.75
20	14	S. J. Kübel	Traveling expenses	18.30
20	15	John C. Parker	Engravers' supplies	1.00
19	16	Adams Express Co	Freight charges	6.80
28	17	E. E. Jackson & Co	Engravers' supplies	28.50
28	18	Hermann Schmidt & Co	Lithographic stone	46.40
28	19	Bulkley, Ward & Co	Engravers' supplies	66.20
31	20	Ohmer File Case Co	Map cases	166.00
31	21	Pay roll of employés	Services, May, 1892	1,929.29
		Total		2,933.69
June 4	1	United States Electric Lighting Co.	Use of 4 horse power current, May, 1892.	$25.00
3	2	Washington Construction Co	Engravers' supplies	3.50
9	3	C. R. Carver	do	18.65
9	4	Chas. Hellmuth	do	104.50
11	5	Z. D. Gilman	do	13.45
11	6	James Talty	Setting sink	20.00
7	7	U. S. Express Co	Freight charges	1.45
13	8	Buffalo Dental Manufacturing Co	Engravers' supplies	10.50
13	9	Adams Express Co	Freight charges	1.15

Abstract of disbursements made by Jno. D. McChesney, etc.—Continued.

GEOLOGICAL MAPS OF THE UNITED STATES, 1892—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
June 15	10	Stephenson's Express	Freight charges	$1.22
15	11	Geo. Meier & Co	Engravers' supplies	244.32
21	12	J C. Entwistle	do	12.00
23	13	Fred A. Schmidt	do	135.00
23	14	Geo. Meier & Co	do	25.00
25	15	Fuchs & Lang	do	9.12
25	16	Milton Bradley Company	do	10.94
25	17	N. Y. Steel and Copper Plate Co.	Copper plates	168.75
28	18	Geo. W. Knox Express	Freight charges and hauling	28.59
28	19	Chas. G. Stott & Co	Paper tubes	104.75
29	20	Henry Lindenmeyr	Engravers' supplies	13.20
29	21	Ernest Kübel	Electrotyping 10 plates	214.50
30	22	R. Hoe & Co	Repairing press	25.95
30	23	Washington Construction Co	Engravers' supplies	30.00
30	24	J. F. Manning	Marble slabs	8.00
30	25	R. Hoe & Co	Lithographic press	3,250.00
30	26	Z. D. Gilman	Engravers' supplies	169.76
30	27	Pay roll of employés	Services, June, 1892	1,899.20
30	28	L. H. Schneider's Son	Engravers' supplies	1.37
30	29	Kennedy & Schaefer	Portable washstands	75.00
		Total		6,624.82

Abstract of disbursements made by C. D. Davis, special disbursing agent, U. S. Geological Survey, during the fiscal year 1891–'92.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY.

1891.				
July 15	1	Bailey Willis	Traveling expenses	$44.50
16	2	G. K. Gilbert	Field expenses	7.00
17	3	Arthur Keith	Traveling expenses	70.40
18	4	Bailey Willis	do	46.32
20	5	T. Nelson Dale	do	23.55
20	6	H. D. Campbell	do	11.50
21	7	R. Macallister	do	16.86
21	8	Sheriden & Quincy	Repairs to outfit	32.50
23	9	R. S. Tarr	Field expenses	14.75
23	10	Ben K. Emerson	Traveling expenses	62.84
27	11	G. K. Gilbert	do	39.65
27	12	N. H. Darton	Field expenses	75.00
31	13	J. D. Rose	Services, July, 1891	45.00
31	14	W. A. Holmes	do	45.00
31	15	W. T. Turner	do	40.00
31	16	Edwin . Paul	do	50.00
31	17	W. Lindgren	do	150.55
31	18	H. W. Turner	do	151.60
31	19	C. Willard Hayes	do	117.90
31	20	Ben K. Emerson	do	100.00
51	21	Lawrence C. Johnson	do	117.90
31	22	Arthur Keith	do	134.80
31	23	Pay roll of employés	do	231.10
31	24	G. F. Becker	do	337.00
31	25	A. C. Peale	do	168.50
31	26	J. S. Diller	do	202.20
31	27	George H. Chase	Supplies	18.37
31	28	Raphael Pumpelly	Services, July, 1891	337.00
31	29	T. Nelson Dale	Traveling expenses	19.52
31	30	do	Services, July, 1891	151.60
31	31	C. L. Whittle	do	100.00
31	32	M. M. J. Vea	do	40.00
31	33	J. E. Wolff	do	151.60
31	34	Geo. H. Shields, jr	do	50.00
31	35	Wm. H. Hobbs	do	100.00
31	36	I. C. Russell	do	202.20
31	37	Pay roll of employés	do	589.70
31	38	Pay roll of employes	do	1,936.70
31	39	do	do	125.00
31	40	Geo. H. Stone	do	50.00
31	41	R. E. Dodge	do	50.00
31	42	do	Traveling expenses	100.44
31	43	J. E. Wolff	do	59.94
31	44	F. C. Boyce	Services, July, 1891	65.00
31	45	W. Young	do	40.00
31	46	L. H. Davis	do	50.00
31	47	R. S. Tarr	do	100.00
31	48	J. R. Finlay	do	50.00

Abstract of disbursements made by C. D. Davis, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
July 31	49	C. R. Eastman	Services, July, 1891	$50.00
31	50	Geo. E. Luther	do	101.10
31	51	C. R. Van Hise	do	337.00
31	52	W. N. Merriam	do	105.00
31	53	Richard McCulloch	do	60.00
31	54	W. P. Jenney	do	185.30
31	55	J. B. Woodworth	do	50.00
31	56	W. S. Bailey	do	135.00
31	57	Amable Dubé	do	60.00
31	58	L. H. Smith	do	60.00
31	59	Robert Howie	do	60.00
31	60	Chas. Oley	do	90.00
31	61	E. T. Erickson	do	60.00
31	62	Ben. G. Palmer	do	25.00
31	63	Cooper Curtice	do	150.00
31	64	L. G. Westgate	do	50.00
31	65	do	do	46.00
		Total		8,347.89
Aug. 6	1	L. H. Davis	Traveling expenses	51.41
6	2	W. T. Lander	do	17.85
6	3	Louis Kahlenberg	do	29.68
6	4	W. H. Hobbs	do	52.19
6	5	Geo. W. Metcalf	do	15.54
6	6	W. T. Lander	Field expenses	7.55
6	7	S. W. Loper	Services, July, 1891	43.54
6	8	N. S. Shaler	do	270.00
6	9	Richard Bliss	do	29.10
6	10	W. T. Lander	do	48.39
6	11	Geo. H. Williams	do	125.00
6	12	J. E. Wolff	Field supplies	26.65
6	13	E. B. Richardson	Care of horse	10.00
6	14	A. P. Baker	Rent of office	43.75
6	15	M. R. Campbell	Field expenses	120.31
8	16	H. Roy Gilbert	Collecting	1.00
14	17	James Storrs	Services, July, 1891	37.26
6	18	C. W. Merrill	do	38.70
14	19	Will. Q. Brown	do	58.06
14	20	H. W. Turner	Field expenses	68.32
14	21	W. Lindgren	Traveling expenses	44.05
14	22	Cooper Curtice	do	71.52
14	23	Wm. North Rice	do	33.52
14	24	do	do	6.93
14	25	do	Services, July, 1891	38.71
14	26	Arthur Keith	Traveling expenses	84.10
17	27	W. P. Jenney	do	251.65
17	28	Wm. Hallock	do	61.49
17	29	S. Ward Loper	do	44.75
17	30	C. R. Van Hise	do	81.47
17	31	J. C. Young	Subsistence	131.25
17	32	Edwin Brewster	Services, July, 1891	50.00
17	33	W. & L. E. Gurley	Instruments	12.50
17	34	do	do	21.60
17	35	James G. Bowen	Care of animals	21.50
17	36	Goldberg, Bowen & Co	Supplies	39.42
17	37	Harry B. Kummel	Services, July, 1891	48.38
17	38	Frank Leverett	do	130.00
17	39	Joseph Bodett	do	45.00
17	40	Samuel Cramer	do	45.00
17	41	Francis P. King	do	60.00
17	42	Henry S. Smith	do	60.00
17	43	Bailey Willis	Traveling expenses	60.47
17	44	G. K. Gilbert	do	88.77
17	45	R. S. Tarr	do	29.25
17	46	Warren Upham	Services, July, 1891	132.61
17	47	J. R. Finlay	Traveling expenses	53.87
17	48	C. R. Eastman	do	92.22
10	49	H. W. Johnson	Services, July 13 to August 13, 1891	50.00
21	50	Wm. Orr, jr	Traveling expenses	35.70
21	51	do	Services	24.00
21	52	Raphael Pumpelly	Rent of post-office box, etc	7.45
21	53	Joseph H. Perry	Services, July, 1891	44.00
21	54	do	Traveling expenses	26.47
21	55	T. Nelson Dale	do	33.15
21	56	H. W. Turner	do	98.25
22	57	Henry B. Kummel	do	52.76
24	58	Edmund Jüssen	do	59.45
24	59	Frank Leverett	do	23.10
28	60	Jno. B. Bean	Hire of transportation	255.00

Abstract of disbursements made by C. D. Davis, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Aug. 28	61	Noah R. King	Services	$137.50
28	62	W. P. Redmond	do	62.10
28	63	Chas. O. Loughry	do	112.00
28	64	James Forristell	do	20.00
31	65	W. Lindgren	Services, August, 1891	151.60
31	66	H. W. Turner	do	151.60
31	67	W. T. Turner	do	40.00
31	68	J. D. Rose	do	12.25
31	69	S. C. Chaney	do	34.84
31	70	W. A. Holmes	do	45.00
31	71	T. Nelson Dale	do	151.60
31	72	J. S. Diller	do	202.20
31	73	C. W. Hayes	do	117.90
31	74	Edmund Jusse	do	75.80
31	75	I. C. Russell	do	202.20
31	76	G. F. Becker	do	337.00
31	77	A. C. Peale	do	168.50
31	78	Arthur Keith	do	134.80
31	79	Pay roll of employés	do	589.70
31	80	do	do	99.86
31	81	do	do	1,910.90
31	82	William Hallock	Traveling expenses	11.55
31	83	Lawrence C. Johnson	Services, August, 1891	117.90
31	84	R. S. Tarr	Traveling expenses	37.55
31	85	R. D. Salisbury	Services, July 1 to August 25, 1891	49.00
		Total		8,617.01
Sept. 1	1	Raphael Pumpelly	Services, August, 1891	337.00
1	2	do	Traveling expenses	73.41
1	3	R. E. Dodge	do	84.38
1	4	do	Services, August, 1891	50.00
1	5	W. J. McGee	Traveling expenses	10.40
1	6	do	do	29.92
1	7	E. W. Hilgard	Services	250.00
2	8	Geo. H. Barton	Services, July, 1891	50.00
2	9	do	Traveling expenses	112.26
2	10	Wm. H. Hobbs	Services, August, 1891	93.55
2	11	J. E. Wolff	Traveling expenses	20.72
2	12	do	do	53.75
2	13	do	Field expenses	6.82
2	14	do	Services, August, 1891	151.60
2	15	Will. O. Brown	do	75.00
2	16	E. G. Paul	do	50.00
2	17	James Storrs	do	55.00
3	18	W. M. Davis	Services, July, 1891	18.00
5	19	do	Traveling expenses	19.35
5	20	Edwin T. Brewster	do	42.42
5	21	R. S. Tarr	Services, August, 1891	100.00
5	22	N. S. Shaler	do	260.00
5	23	C. S. Whittle	do	100.00
5	24	B. K. Emerson	do	100.00
5	25	F. P. King	do	60.00
5	26	W. S. Bayley	do	130.00
5	27	Geo. E. Luther	do	101.10
5	28	Chas. Oley	do	90.00
5	29	C. R. Van Hise	do	337.00
5	30	Harry Ball	do	40.00
5	31	B. G. Palmer	do	25.00
5	32	E. T. Erickson	do	75.00
5	33	Robt. Howie	do	56.13
5	34	Pay roll of employés	do	231.10
5	35	T. Nelson Dale	Field expenses	3.99
5	36	do	Traveling expenses	25.70
5	37	James G. Bowen	Forage, etc	32.25
7	38	Geo. F. Backer	Field expenses	167.40
7	39	W. & L. E. Gurley	Instruments	36.04
7	40	J. T. Masters	Pasturage	10.00
7	41	M. M. J. Vea	Services, August, 1891	40.00
7	42	A. P. Baker	Rent of office	43.75
7	43	W. A. Richardson	Services	7.50
7	44	L. H. Davis	Services, August, 1891	50.00
7	45	J. B. Woodworth	do	50.00
8	46	Geo. H. Shields, jr	do	50.00
8	47	W. P. Jenney	do	185.30
8	48	Richard McCulloch	do	60.00
8	49	Henry B. Kummel	do	38.70
8	50	do	Traveling expenses	38.00
8	51	Lawrence C. Johnson	do	88.58
8	52	W. Lindgren	Field expenses	53.95

Abstract of disbursements made by C. D. Davis, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher	To whom paid.	For what paid.	Amount.
1891.				
Sept. 8	53	W. P. Jenney	Field expenses	$120.33
8	54	do	do	61.20
8	55	B. K. Emerson	Traveling expenses	126.40
8	56	Goldberg, Bowen & Co	Supplies	45.85
8	57	S. J. Meeks	Repairs	1.00
9	58	Warren Upham	Services, August, 1891	134.80
14	59	Wm. Hallock	Traveling expenses	70.20
17	60	Cooper Curtice	Services, August, 1891	150.00
17	61	T. Nelson Dale	Traveling expenses	55.53
17	63	W. P. Jenney	do	125.55
17	64	do	Field expenses	100.90
17	65	W. S. Bayley	do	65.37
17	66	Cyrus C. Babb	do	16.50
17	67	Aug. F. Foerste	Services, August, 1891	63.87
17	68	do	Traveling expenses	30.54
17	69	Wm. Orr, jr	do	27.10
17	70	do	Services, August, 189	17.00
17	71	J. C. Young	Field expenses	142.18
17	72	Louis Kahlenberg	Traveling expenses	65.30
17	73	Joseph H. Perry	Services, August, 1891	42.00
17	74	J. E. Spurr	Traveling expenses	31.74
17	75	Jos. H. Perry	do	40.67
17	76	M. R. Campbell	Field expenses	100.86
17	77	L. G. Westgate	Services, August, 1891	33.87
17	78	R. MacAllister	Traveling expenses	26.30
17	79	Cooper Curtice	do	233.70
17	80	J. A. Holmes	Services	200.00
18	81	L. H. Davis	Traveling expenses	56.33
22	82	H. W. Turner	Field expenses	111.13
22	83	Joseph Sellwood & Co	Supplies	22.78
22	84	do	do	83.59
22	85	L. H. Smith	Services, September, 1891	30.00
22	86	J. B. Woodworth	Traveling expenses	20.39
22	87	Louis Kahlenberg	Services, July and August, 1891	40.00
22	88	E. T. Brewster	Services, August, 1891	50.00
23	89	Geo. H. Barton	Traveling expenses	108.73
30	90	C. Willard Hayes	Services, September, 1891	114.20
30	91	J. S. Diller	do	195.60
30	92	Cooper Curtice	do	150.00
30	93	Bailey Willis	do	244.60
30	94	H. W. Turner	do	146.80
30	95	W. Lindgren	do	146.80
30	96	F. C. Boyce	do	65.00
30	97	do	Services, August, 1891	65.00
30	98	Arthur Keith	Services, September, 1891	130.40
30	99	G. F. Becker	do	326.00
30	100	E. H. Shuster	do	97.80
30	101	N. Y. and Boston Despatch Express Co.	Expressage	6.65
30	102	S. C. Chaney	Services, September, 1891	50.00
30	103	W. T. Turner	do	40.00
30	104	T. Nelson Dale	Traveling expenses	58.38
30	105	do	Services, September, 1891	146.80
30	106	do	Services, August, 1891	60.00
30	107	J. T. Masten	Pasturage	10.00
30	108	C. R. Van Hise	Services, September, 1891	326.00
30	109	Geo. E. Luther	do	97.80
30	110	E. T. Erickson	do	75.00
30	111	J. B. Woodworth	Traveling expenses	45.86
30	112	Harry Landes	do	33.66
30	113	Robert Wainwright	do	52.41
30	114	L. G. Westgate	do	39.28
30	115	Edmund Jüssen	do	81.13
30	116	William B. Clark	Services, August and September, 1891	205.00
30	117	I. C. Russell	Services, September, 1891	195.60
30	118	C. Whitman Cross	do	163.00
30	119	N. H. Darton	do	122.20
30	120	W. J. McGee	do	244.60
30	121	Pay roll of employés	do	1,409.90
30	122	do	do	163.00
30	123	W. H. Snyder	Traveling expenses	67.83
30	124	C. L. Whittle	do	212.14
30	125	J. E. Wolff	Services, September, 1891	146.80
30	126	J. B. Woodworth	do	50.00
30	127	N. S. Shaler	do	260.00
30	128	R. S. Tarr	do	100.00
30	129	J. M. Safford	Services, July, 1891	92.91
30	130	do	Services, August, 1891	24.45
30	131	B. F. Caldwell	Supplies	8.65
30	132	Goldberg, Bowen & Co	do	15.72

Abstract of disbursements made by C. D. Davis, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891. Sept. 30	133	W. Lindgren	Expenses	$57.40
30	134	Wm. K. Coskey	Feeding animal	28.00
30	135	J. M. Safford	Traveling expenses	46.30
30	136	......do	......do	8.40
30	137	......do	......do	16.85
		Total		13,315.70
Oct. 7	1	Pay roll of employés	Services, September, 1891	217.80
7	2	L. G. Westgate	......do	38.33
7	3	L. H. Davis	......do	38.33
7	4	Harry Landes	......do	30.00
7	5	Edwin T. Brewster	......do	6.67
7	6	H. W. Johnson	......do	38.33
7	7	M. R. Campbell	Subsistence	84.41
8	8	Lawrence C. Johnson	Services, September, 1891	114.20
8	9	George H. Shields, jr	......do	50.00
8	10	Wm. H. Hobbs	Traveling expenses	135.50
8	11	N. H. Darton	......do	276.87
9	12	Harry Landes	......do	34.60
9	13	J. E. Spurr	......do	46.82
9	14	Henry B. Kummel	......do	56.09
9	15	L. H. Davis	......do	40.25
9	16	L. G. Westgate	......do	48.95
9	17	R. S. Tarr	......do	52.67
9	18	Henry B. Kummel	Services, September, 1891	38.33
9	19	L. G. Westgate	Services, August, 1891	4.84
9	20	Warren Upham	Services, September, 1891	130.40
10	21	E. T. Brewster	Traveling expenses	67.67
10	22	J. E. Wolff	......do	74.54
10	23	Alpheus Hyatt	......do	39.09
10	24	......do	......do	73.18
10	25	Gosselin & Poulin	Subsistence	95.23
10	26	W. J. McGee	Traveling expenses	167.95
13	27	......do	......do	109.10
13	28	Lawrence C. Johnson	......do	51.12
16	29	Aug. F. Foerste	......do	53.09
16	30	Geo. E. Luther	......do	30.43
16	31	W. S. Bayley	......do	81.45
16	32	Bailey Willis	......do	74.57
16	33	T. Nelson Dale	......do	67.52
16	34	C. R. Eastman	......do	48.95
16	35	Ben. G. Palmer	Services, September, 1891	25.00
16	36	Aug. F. Foerste	......do	110.00
16	37	James Storrs	......do	55.00
16	38	C. L. Whittle	......do	100.00
16	39	Will. Q. Brown	......do	75.00
16	40	M. M. J. Vea	......do	40.00
16	41	Ben. K. Emerson	......do	100.00
16	42	Raphael Pumpelly	......do	326.00
16	43	C. R. Eastman	Services, August	35.48
16	44	J. L. Van Horn	Services, September	44.00
16	45	Amable Dubé	......do	24.00
16	46	Harry Ball	......do	34.00
16	47	Francis P. King	......do	84.65
16	48	Chas. Oley	......do	90.00
16	49	Francis Hinds	......do	16.33
16	50	Richard McCulloch	......do	60.00
16	51	The Library Bureau	Index cards	7.80
16	52	Nels. Majhammer & Co	Supplies	15.24
17	53	Ole Walseth	Hire of transportation	21.00
17	54	Richard Bliss	Bibliographic work	40.80
17	55	A. P. Baker	Rent	43.75
17	56	James G. Bowen	Hire of transportation.	13.00
19	57	S. F. Emmons	Services, September, 1891	326.00
19	58	W. P. Jenney	Traveling expenses	139.97
19	59	Jos. Sellwood & Co	Supplies	65.51
20	60	Raphael Pumpelly	Field expenses	46.24
20	61	......do	Traveling expenses	20.80
20	62	C. R. Van Hise	......do	348.49
20	63	H. W. Turner	Field expenses	74.00
20	64	T. Nelson Dale	......do	2.20
20	65	Frank Leverett	Services, August 1 to October 9, 1891.	300.00
27	66	J. V. Lewis	Traveling expenses	15.05
29	67	J. C. Young	Supplies	81.99
27	68	J. E. Wolff	Field expenses	25.80
27	69	W. H. Snyder	Services, July 28 to August 27, 1891.	50.00
27	70	The Eastman Co	Services	7.20

Abstract of disbursements made by C. D. Davis, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Oct. 27	71	Providence Telephone Co	Services, July, August, and September, 1891.	$11.50
27	72	Wm. K. Caskey	Care of horses	21.00
31	73	Bailey Willis	Services, October, 1891	252.70
31	74	H. W. Turner	do	151.60
31	75	W. Lindgren	do	151.60
31	76	Lawrence C. Johnson	do	117.90
31	77	Cooper Curtice	do	150.00
31	78	T. Nelson Dale	do	151.60
31	79	I. C. Russell	Field expenses	939.14
31	80	do	Traveling expenses	433.75
31	81	N. S. Shaler	Services, October, 1891	270.00
31	82	E. H. Shuster	do	101.10
31	83	Pay roll of employés	do	1,587.83
31	84	do	do	960.40
31	85	N. H. Darton	do	126.40
31	86	Eugene A. Smith	do	200.00
31	87	Raphael Pumpelly	do	337.00
31	88	F. C. Boyce	do	65.00
31	89	Geo. H. Barton	Services, August and September, 1891.	120.00
31	90	J. E. Wolff	Traveling expenses	22.40
31	91	W. Lindgren	Field expenses	75.20
31	92	Francis P. King	Traveling expenses	103.04
31	93	C. L. Whittle	do	254.57
31	94	G. K. Gilbert	do	51.00
		Total		12,036.31
Nov. 11	1	G. K. Gilbert	Field expenses	62.86
9	2	J. B. Woodworth	Services, October, 1891	50.00
9	3	C. R. Van Hise	do	337.00
9	4	Geo. E. Luther	do	101.10
9	5	W. S. Bayley	do	102.50
9	6	R. E. Dodge	do	50.00
9	7	Pay roll of employés	do	155.30
9	8	M. M. J. Vea	do	40.00
9	9	C. L. Whittle	do	100.00
9	10	R. S. Tarr	do	100.00
9	11	L. G. Westgate	do	6.45
9	12	J. E. Wolff	do	83.15
9	13	Wm. North Rice	Services, August, 1891	24.19
9	14	Bailey Willis	Traveling expenses	207.64
9	15	M. R. Campbell	Field expenses	52.57
9	16	R. Macallister	Traveling expenses	47.33
9	17	Wm. North Rice	do	21.99
10	18	J. S. Diller	do	90.95
10	19	Edwin G. Paul	do	80.70
10	20	W. P. Jenney	do	159.95
10	21	Geo. H. Williams	Services, August, 1891	110.00
10	22	Edwin G. Paul	Services, September and October, 1891.	100.00
10	23	J. S. Diller	Services, October, 1891	202.20
10	24	W. E. Knibloe	Services	10.00
10	25	W. A. Holmes	Services, September 1 to October 28, 1891.	85.65
10	26	W. S. Bayley	Services, September, 1891	130.00
10	27	S. C. Chaney	Services, October, 1891	45.16
10	28	Arthur Keith	do	134.80
10	29	Geo. H. Shields, jr	do	50.00
10	30	Ben. G. Palmer	do	25.00
10	31	Wm. B. Clark	do	75.00
10	32	Geo. H. Williams	do	85.00
10	33	E. W. Hilgard	Services	250.00
10	34	E. R. Richardson	Care of animals	30.00
10	35	Adams & Ilsley	Canvas cases	9.00
10	36	Richard Bliss	Bibliographic work	24.30
10	37	A. P. Baker	Rent of office	43.75
10	38	C. R. Van Hise	Field expenses	44.98
10	39	T. Nelson Dale	do	10.57
10	40	W. P. Jenney	do	75.31
10	41	do	do	96.79
10	42	J. S. Diller	do	306.90
12	43	L. S. Griswold	Traveling expenses	50.08
12	44	A. C. Peale	do	201.35
12	45	Cooper Curtice	do	202.54
12	46	L. C. Johnson	do	83.21
12	47	M. R. Campbell	do	30.29
12	48	J. H. Case	Field expenses	30.67
12	49	J. C. Young	Board, etc	35.69

Abstract of disbursements made by C. D. Davis, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Nov. 12	50	L. S. Griswold	Services, September, 1891	$12.50
12	51	do	Services, October, 1891	50.80
12	52	Jas. Storrs	Services, October and November, 1891.	64.17
12	53	W. T. Turner	do	53.33
12	54	C. W. Hall	Services	63.00
12	55	Cyrus C. Babb	do	12.00
12	56	G. F. Becker	Services, October, 1891	337.00
16	57	H. W. Turner	Field expenses	92.32
16	58	W. Lindgren	do	106.45
16	59	C. Whitman Cross	Services, October, 1891	168.50
21	60	A. C. Peale	Field expenses	106.30
30	61	W. Lindgren	Services, November, 1891	146.80
		Total		5.665.09
Dec. 2	1	Lawrence C. Johnson	Services, November, 1891	114.20
2	2	Edmund Jüssen	do	73.40
7	3	T. C. Boyd	do	65.00
11	4	N. H. Darton	Traveling expenses	152.00
11	5	R. S. Tarr	Services, November, 1891	100.00
11	6	J. E. Wolff	do	92.93
11	7	Warren Upham	do	130.40
11	8	Frank Leverett	do	220.00
11	9	Jas. R. Thomson	Services	18.00
11	10	W. H. Hobbs	Field expenses	34.98
11	11	The Knickerbocker Press	Box trays	29.25
11	12	Wm. Andrews	Freight charges, etc	18.30
11	13	Ben. K. Emerson	Services, October, 1891	100.00
11	14	Warren Upham	do	134.80
11	15	W. N. Merriam	Traveling expenses	10.84
11	16	Geo. E. Luther	Services, November, 1891	97.80
11	17	E. T. Eriksen	Services, October and November, 1891.	41.94
11	18	Robt. Howie	Services, September, 1891	12.00
11	19	C. L. Whittle	Services, November, 1891	100.00
11	20	C. R. Van Hise	do	326.00
11	21	Raphael Pumpelly	do	326.00
11	22	N. S. Shaler	do	250.00
11	23	W. S. Bayley	do	100.00
11	24	A. P. Baker	Rent of rooms	43.75
11	25	Ben. G. Palmer	Services, November, 1891	25.00
11	26	Richard McCulloch	Services, October, 1891	90.00
11	27	M. M. J. Vea	Services, November, 1891	12.00
11	28	W. Lindgren	Field expenses	68.25
11	29	Frank Leverett	Traveling expenses	41.75
11	30	M. R. Campbell	Services, November, 1891	97.80
11	31	Geo. H. Williams	do	95.00
11	32	W. H. McLeod	Services, October and November, 1891.	40.00
11	33	I. C. Russell	Cash payments	6.75
11	34	Geo. H. Barton	Traveling expenses	83.17
11	35	R. S. Tarr	do	17.72
11	36	F. B. Beck	do	102.39
11	37	W. J. McGee	do	14.20
11	38	H. W. Turner	do	92.20
11	39	Aug. F. Foerste	do	79.52
11	40	do	do	10.55
11	41	do	Services, October and November, 1891.	136.02
11	42	C. L. Whittle	Traveling expenses	89.16
11	43	Jas. Hardy Ropes	Services	44.03
11	44	Geo. H. Shields, jr	Services, November, 1891	50.00
11	45	J. H. Case	Subsistence	19.25
11	46	T. Nelson Dale	Services, November, 1891	146.80
11	47	Wemple Bros	Paper boxes	22.50
11	48	J. E. Wolff	Traveling expenses	39.36
11	49	C. L. Whittle	Field services	120.00
11	50	T. Nelson Dale	Preparation of specimen	3.50
11	51	T. S. Kensey	Services	32.50
11	52	Wm. B. Clark	Services, November, 1891	80.00
11	53	J. B. Woodworth	do	50.00
11	54	R. E. Dodge	do	30.00
11	55	Jas. Hardy Ropes	Traveling expenses	78.05
11	56	C. W. Hayes	do	147.08
12	57	C. Willard Hayes	Services, November, 1891	114.20
12	58	Thomas Parry	Traveling expenses	18.05
12	59	H. W. Turner	Services, November, 1891	146.80
12	60	Bailey Willis	Traveling expenses	97.75
12	61	Arthur Keith	Services, November, 1891	130.40

Abstract of disbursements made by C. D. Davis, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Dec. 15	62	G. K. Gilbert	Services, November, 1891	$346.30
12	63	......do	Field expenses	476.56
12	64	......do	Traveling expenses	47.00
12	65	......do	......do	4.15
12	66	Marcus Baker	......do	44.85
11	67	M. M. J. Vea	......do	60.51
16	68	Arthur Keith	......do	204.55
16	69	Edmund Otis Hovey	Services, September, 1891	11.25
16	70	......do	Services, October, 1891	3.02
15	71	Edmund Jüssen	Traveling expenses	98.06
15	72	N. H. Darton	......do	59.45
17	73	Arthur Keith	......do	181.78
17	74	Geo. H. Shields, jr	Field expenses	10.50
17	75	H. W. Turner	......do	46.05
17	76	R. Pumpelly	......do	18.50
18	77	L. S. Griswold	Traveling expenses	78.12
18	78	......do	Services, November, 1891	75.00
19	79	J. M. Safford	Services, October, 1891	29.34
19	80	......do	Services, November, 1891	4.87
19	81	Gosselin & Poulin	Subsistence	110.94
19	82	E. D. Keyes & Co	Supplies	50.74
19	83	Richard Bliss	Services	24.90
19	84	Ben. K. Emerson	Services, November, 1891	100.00
19	85	E. T. Eriksen	Traveling expenses	16.87
19	86	G. C. Temple	......do	10.35
19	87	L. G. Westgate	Services, November, 1891	5.00
19	88	C. R. Van Hise	Field expenses	59.09
19	89	Cyrus C. Babb	......do	10.50
19	90	J. T. Masten	Pasturage	41.00
19	91	Jas. M. Safford	Boarding	1.40
19	92	......do	Field expenses	11.35
21	93	Frank C. Schrader	Traveling expenses	152.87
21	94	......do	Services, August 25, October 31, 1891.	166.94
31	95	M. R. Campbell	Services, December, 1891	101.10
31	96	L. C. Johnson	......do	117.90
31	97	Edmund Jüssen	......do	75.80
31	98	T. Nelson Dale	......do	151.60
31	99	H. W. Turner	......do	151.60
31	100	W. Lindgren	......do	151.60
31	101	Edmund Jüssen	Field expenses	7.45
31	102	G. K. Gilbert	Services, December, 1891	358.10
31	103	Pay roll of employés	......do	1,499.60
31	104	......do	......do	1,987.10
31	105	William B. Clark	......do	105.00
31	106	Ben. G. Palmer	......do	25.00
31	107	W. J. McGee	Traveling expenses	135.40
31	108	Wm. K. Caskey	Board, etc	35.00
31	109	L. C. Johnson	Traveling expenses	147.28
31	110	......do	......do	35.00
31	111	H. W. Turner	......do	116.40
31	112	S. F. Emmons	......do	295.00
31	113	Edmund Jussen	......do	105.31
31	114	C. Whitman Cross	......do	248.35
31	115	W. Lindgren	......do	58.25
31	116	Wm. H. Hobbs	Services	20.12
31	117	......do	Services, November, 1891	100.00
31	118	C. L. Whittle	Services, December, 1891	100.00
31	119	Raphael Pumpelly	......do	337.00
31	120	C. R. Van Hise	......do	337.00
31	121	Geo. E. Luther	......do	101.10
31	122	W. N. Luther	......do	35.00
31	123	E. T. Eriksen	......do	55.65
31	124	New York and Boston Despatch Express Co.	Expressage	12.00
31	125	W. Lindgren	Field expenses	47.50
		Total		14,684.32
1892.				
Jan. 17	1	C. L. Whittle	Traveling expenses	262.96
16	2	Richard Bliss	Services, December, 1891	23.10
16	3	L. G. Westgate	......do	11.29
16	4	R. S. Tarr	......do	100.00
16	5	L. S. Griswold	......do	44.75
16	6	Frank Leverett	......do	135.00
16	7	R. D. Dodds	......do	30.00
16	8	W. S. Bayley	......do	95.00
16	9	Warren Upham	......do	134.80
16	10	J. B. Woodworth	......do	50.00
16	11	J. E. Wolff	......do	92.98

Abstract of disbursements made by C. D. Davis, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
Jan. 16	12	Geo. H. Williams	Services, December, 1891	$65.00
10	13	G. K. Gilbert	Traveling expenses	10.10
16	14	N. H. Darton	do	56.51
16	15	R. S. Griswold	do	34.88
16	16	J. B. Woodworth	do	20.33
16	17	M. R. Campbell	do	48.00
16	18	A. Buford	Services, September 14 to December 31, 1891.	178.33
16	19	W. J. Park & Sons	Field supplies	29.38
16	20	L. C. Johnson	do	44.31
16	21	W. H. Walmsley	Photo plates	8.78
10	22	Keuffel & Esser Co	Paper	10.40
16	23	J. F. Master	Forage	30.00
16	24	Newport Waterworks	Water rent	7.50
16	25	A. P. Baker	Rent of rooms	43.75
19	26	W. F. Fling	Care of public animals	32.00
19	27	W. P. Jenney	Traveling expenses	234.80
19	28	do	Field expenses	89.52
23	29	Peterson, Olson & Co	Supplies	42.50
23	30	B. K. Emerson	Services, December, 1891	100.00
23	31	R. S. Tarr	Traveling expenses	25.30
23	32	J. E. Wolff	do	14.75
23	33	do	do	23.49
25	34	Edmund Jüssen	do	142.68
27	35	Wisconsin Typewriter Co	Letter files	24.06
27	36	C. W. Hall	Services	22.50
27	37	C. R. Van Hise	Expenses	88.71
27	38	W. P. Jenney	Services, September 1 to December 31, 1891.	729.40
31	39	W. Lindgren	Services, January, 1892	153.30
31	40	N. S. Shaler	do	260.00
31	41	T. Nelson Dale	do	170.30
31	42	N. H. Darton	do	127.70
31	43	Edmund Jüssen	do	76.60
31	44	Pay roll of employés	do	1,516.00
31	45	do	do	2,399.59
		Total		7,840.24
Feb. 1	1	J. B. Woodworth	Services, January, 1892	50.00
1	2	R. E. Dodge	do	30.00
1	3	W. S. Bayley	do	100.00
1	4	H. W. Turner	do	153.30
1	5	C. R. Van Hise	do	340.70
1	6	Raphael Pumpelly	do	340.70
1	7	J. E. Wolff	Field expenses	22.70
1	8	B. K. Emerson	do	38.82
1	9	Wm. K. Caskey	Care of horses	9.00
1	10	Providence Telephone Co	Services, January, 1892	11.50
1	11	C. M. Harlan	Care of public animals	70.46
1	12	Frank C. Schrader	Services, Nov. and Dec., 1891	150.00
1	13	Raphael Pumpelly	Field expenses	14.90
2	14	W. Lindgren	do	50.85
2	15	H. W. Turner	do	165.75
2	16	Geo. E. Luther	Services, January, 1892	102.20
2	17	W. A. Holmes	Services	82.98
2	18	Lawrence C. Johnson	Services, January, 1892	119.20
3	19	Ben. G. Palmer	do	25.00
3	20	Frank Leverett	do	130.00
3	21	Henry A. Clarke & Son	Repairs	7.50
3	22	A. P. Baker	Rent of rooms	43.75
4	23	Wm. A. Wansleben	Services, January, 1892	16.00
4	24	C. L. Whittle	do	100.00
4	25	R. D. Salisbury	Traveling expenses	209.13
6	26	J. T. Masten	Care of public animals	45.00
6	27	George H. Williams	Services, January, 1892	25.00
9	28	B. K. Emerson	Traveling expenses	140.11
9	29	Richard Bliss	Services, January, 1892	27.30
10	30	Gilbert D. Harris	Traveling expenses	199.77
12	31	R. S. Tarr	Services, January, 1892	64.52
12	32	Warren Upham	do	136.30
12	33	J. E. Wolff	do	96.77
12	84	L. G. Griswold	do	18.14
12	35	L. G. Westgate	do	16.13
17	36	Jas. R. Thompson	do	14.00
17	37	Geo. H. Chase	Services	12.75
17	38	S. Ward Loper	do	27.82
17	39	Edmund Jüssen	Services, February 1 to 9, 1892	23.27
17	40	F. B. Peck	Traveling expenses	12.06
18	41	E. J. Pullman	Photo. plates	2.97

Abstract of disbursements made by C. D. Davis, etc—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
Feb. 19	42	L. S. Smith	Services, February, 1892	$28.45
23	43	G. P. Putnam's Sons	Specimen bags	8.75
22	44	H. D. Campbell	Services	195.00
26	45	Cyrus C. Babb	Field expenses	14.00
26	46	N. H. Darton	Traveling expenses	53.65
29	47	Geo. H. Eldridge	Services, February, 1892	191.20
29	48	Lawrence C. Johnson	......do	111.60
29	49	Jefferson Middleton	......do	111.60
29	50	Pay roll of employés	......do	1,418.00
29	51	......do	......do	2,288.80
29	52	N. S. Shaler	......do	250.00
29	53	J. B. Woodworth	......do	50.00
29	54	R. E. Dodge	......do	30.00
29	55	C. S. Whittle	......do	100.00
29	56	T. Nelson Dale	......do	159.40
29	57	H. W. Turner	......do	143.40
29	58	Geo. E. Luther	......do	95.60
29	59	C. R. Van Hise	......do	318.60
29	60	I. M. Buell	Traveling expenses	130.07
29	61	C. L. Whittle	......do	87.68
		Total		9,032.15
Mar. 2	1	W. Lindgren	Services, February, 1892	143.40
4	2	Raphael Pumpelly	......do	318.60
4	3	Ben. G. Palmer	......do	25.00
4	4	George H. Williams	......do	55.00
4	5	Wm. K. Caskey	Care of public animals	15.00
4	6	A. P. Baker	Rent of rooms	43.75
5	7	L. H. Davis	Services, February, 1892	19.00
5	8	Frank Leverett	......do	125.00
5	9	W. Lindgren	Traveling expenses	106.30
8	10	A. Buford	......do	34.25
8	11	C. R. Van Hise	Field expenses	31.60
8	12	Wm. J. Park & Sons	Supplies	13.18
8	13	Richard Bliss	Services	26.70
8	14	L. S. Griswold	Services, February, 1892	21.98
8	15	W. S. Bayley	......do	90.00
8	16	Warren Upham	......do	127.40
11	17	R. S. Tarr	......do	62.07
11	18	L. G. Westgate	......do	5.17
11	19	J. E. Wolff	......do	103.85
11	20	Geo. H. Eldridge	Traveling expenses	52.86
11	21	S. Ward Loper	......do	50.47
11	22	R. S. Tarr	Miscellaneous expenses	19.24
11	23	E. B. Richardson	Feeding horse	30.20
11	24	Wm. K. Caskey	Board of horse	15.00
11	25	J. T. Masten	Forage	45.00
12	26	Geo. H Eldridge	Field expenses	3.85
11	27	D. W. Davis	Rent of storeroom	20.00
21	28	T. Nelson Dale	Traveling expenses	32.53
21	29	J. E. Baird	Boat, etc	90.50
21	30	G. Potsdamer	Feeding horses	87.25
21	31	H. W. Turner	Traveling expenses	106.85
21	32	Isaiah Rendell	Pasturage, etc	175.70
21	33	Jas. R. Thompson	Services	12.00
22	34	J. E. Wolff	Traveling expenses	37.80
22	35	W. P. Jenney	Services, January and February, 1892.	362.60
22	36	G. E. Culver	Traveling expenses	80.71
29	37	Geo. H. Eldridge	......do	83.38
29	38	......do	Field expenses	2.45
29	39	De Lany & Ives	Supplies	40.79
29	40	Edwin E. Howell	Specimens	48.50
29	41	Sam. C. Partridge	Photo supplies	24.25
29	42	J. H. Perry	Services	32.01
29	43	......do	Traveling expenses	18.71
29	44	Lawrence C. Johnson	......do	91.43
29	45	......do	......do	40.35
29	46	W. P. Jenney	Field supplies	31.21
31	47	Raphael Pumpelly	Services, March, 1892	340.71
31	48	T. Nelson Dale	......do	170.30
31	49	Lawrence C. Johnson	......do	119.20
31	50	H. W. Turner	......do	153.30
31	51	Jefferson Middleton	......do	119.20
31	52	I. C. Russell	......do	204.40
31	53	Geo. H. Eldridge	......do	204.40
31	54	Pay roll of employés	......do	1,311.60
31	55	......do	......do	2,591.84

Abstract of disbursements made by C. D. Davis, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
Mar. 31	56	J. B. Woodworth	Services, March, 1892	$50.00
31	57	N. S. Shaler	do	270.00
31	58	Ben. G. Palmer	do	25.00
31	59	A. Prescott Baker	Rent of rooms	43.75
31	60	C. R. Van Hise	Services, March, 1892	340.70
31	61	Geo. E. Luther	do	102.20
		Total		8,999.47
Apr. 2	1	W. P. Jenney	Services, March, 1892	187.40
7	2	Cyrus C. Babb	Field expenses	10.00
7	3	W. S. Bayley	Services, March, 1892	110.00
7	4	Frank Leverett	do	135.00
7	5	George H. Williams	do	75.00
7	6	Richard Bliss	Bibliographic work	28.80
9	7	Geo. H. Eldridge	Field expenses	57.39
9	8	do	Traveling expenses	54.20
11	9	Frank Leverett	Field expenses	34.09
10	10	C. L. Whittle	Services, March, 1892	100.00
11	11	A. Buford	Services, January 1 to March 31, 1892.	150.00
12	12	L. G. Westgate	Services, March, 1892	8.06
12	13	Warren Upham	do	136.30
12	14	J. E. Wolff	do	103.85
12	15	C. M. Harlan	2 mules	300.00
12	16	A. Buford	Traveling expenses	42.67
12	17	Wm. K. Caskey	Care of horse	15.00
12	18	C. M. Harlan	do	108.00
12	19	A. Buford	Field expenses	80.91
12	20	C. R. Van Hise	Traveling expenses	70.97
16	21	H. D. Campbell	do	4.65
16	22	R. Pumpelly	Field expenses	16.40
16	23	H. D. Campbell	Services, March, 1892	20.00
16	24	Mary L. Wingate	do	26.25
15	25	Geo. H. Shields, jr	Services, April 1 to 15, 1892	25.00
21	26	J. M. Safford	Services, March, 1892	19.78
28	27	I. M. Buell	Services, July 31 to December 31, 1891.	612.50
28	28	Charles J. Moore	do	50.00
29	29	William B. Clark	Services, April 1 to 15, 1892	35.00
29	30	S. J. Taft	do	15.00
30	31	Raphael Pumpelly	Services, April, 1892	329.70
30	32	Lawrence C. Johnson	do	115.40
30	33	T. Nelson Dale	do	164.80
30	34	H. W. Turner	do	148.30
30	35	J. T. Masten	Forage	45.00
30	36	W. P. Jenney	Services, April, 1892	181.30
30	37	Geo. H. Eldridge	do	197.80
30	38	I. C. Russell	do	197.80
30	39	Pay roll of employés	do	1,071.45
30	40	do	do	2,829.95
30	41	R. D. Salisbury	do	154.00
30	42	N. S. Shaler	do	260.00
30	43	J. B. Woodworth	do	50.00
30	44	Ben. G. Palmer	do	25.00
30	45	Geo. H. Eldridge	Field expenses	43.85
30	46	do	do	90.00
30	47	J. E. Wolff	Traveling expenses	29.40
30	48	Providence Telephone Co	Services	11.50
30	49	Herbert L. Dyer, agent	Rent, April, 1892	43.75
		Total		8,621.22
May 4	1	C. R. Van Hise	Services, April, 1892	329.70
4	2	Raphael Pumpelly	Traveling expenses	39.30
5	3	C. L. Whittle	Services, April, 1892	100.00
5	4	Geo. E. Luther	do	98.90
4	5	M. R. Campbell	Traveling expenses	94.72
4	6	H. W. Turner	Field expenses	6.50
4	7	do	Traveling expenses	97.90
4	8	N. H. Darton	do	8.29
7	9	Geo. H. Williams	Services, April, 1892	70.00
7	10	J. A. Holmes	Services, January 1 to May 1, 1892	200.00
10	11	J. E. Wolff	Services, April, 1892	98.90
10	12	Frank Leverett	do	130.00
10	13	Warren Upham	do	131.90
11	14	Richard Bliss	do	23.70
11	15	H. H. Harvey	Hammers	12.00
11	16	Voight & Hochgesang	Microscope, etc	164.70
11	17	Citizens' National Bank	Bill of exchange	2.07

Abstract of disbursements made by C. D. Davis, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892. May 19	18	Wm. K. Caskey	Care of horse	$15.00
19	19	J. M. Safford	Services, April, 1892	29.64
19	20	B. K. Emerson	......do	100.00
19	21	R. S. Tarr	Services, March, 1892	64.51
19	22	......do	Services, April, 1892	66.67
19	23	The Knickerbocker Press	Specimen bags	36.97
19	24	J. Kemp Bartlett, jr	Educational Rocks	20.00
19	25	F. B. Furbish	File cases	112.00
19	26	J. T. Masten	Forage	45.00
21	27	Geo. H. Eldridge	Traveling expenses	65.10
21	28	......do	Field expenses	118.41
21	29	R. D. Salisbury	Traveling expenses	112.38
21	30	C. R. Van Hise	......do	62.59
21	31	F. P. King	Services, January, 1892	17.50
21	32	Jas. R. Thompson	Services	30.00
25	33	W. P. Jenney	Field expenses	5.00
25	34	......do	Traveling expenses	45.75
25	35	J. E. Wolff	......do	49.15
25	36	Lawrence C. Johnson	......do	39.30
25	37	Otis S. Hill	Services	90.00
25	38	W. & L. E. Gurley	Repairs to instruments	30.58
25	39	C. L. Whittle	Expenses	114.63
28	40	E. B. Richardson	Care and feeding animal	48.70
28	41	Raphael Pumpelly	Field expenses	25.00
31	42	......do	Services, May, 1892	340.60
31	43	J. S. Diller	......do	204.40
31	44	Lawrence C. Johnson	......do	119.20
31	45	C. R. Van Hise	......do	340.60
31	46	W. P. Jenney	......do	187.40
31	47	N. S. Shaler	......do	260.00
31	48	T. Nelson Dale	......do	170.40
31	49	J. B. Woodworth	......do	50.00
31	50	N. H. Darton	Traveling expenses	41.05
31	51	Geo. H. Eldridge	Services, May, 1892	204.40
31	52	W. Lindgren	......do	153.40
31	53	I. C. Russell	......do	204.40
31	54	Pay roll of employés	......do	1,107.10
31	55	......do	......do	2,966.60
		Total		9,302.01
June 2	1	Arthur Keith	Traveling expenses	42.40
15	2	Andrew C. Lawson	......do	3.40
15	3	J. E. Wolff	Field expenses	29.06
15	4	Frank Leverett	......do	30.75
15	5	Andrew C. Lawson	......do	39.00
15	6	Geo. A. Lake	Leather bags	15.00
15	7	Holway Brothers & Woodbury	Tents	65.00
15	8	Herbert Dyer, agent	Rent of rooms	43.75
15	9	Richard Bliss	Services	25.80
15	10	Andrew C. Lawson	Services, Februsry 13 to March 11, 1892.	35.00
15	11	......do	Services, April, 1892	30.00
15	12	A. S. Penfield	Services, May 1 to 15, 1892	33.87
15	13	L. G. Westgate	Services, May, 1892	9.68
15	14	Ben. G. Palmer	......do	25.00
15	15	R. S. Tarr	......do	64.52
15	16	Frank Leverett	......do	130.00
15	17	Geo. H. Williams	......do	130.00
15	18	C. L. Whittle	......do	100.00
15	19	Warren Upham	......do	136.20
15	20	J. E. Wolff	......do	103.85
15	21	A. S. Penfield	Services, April 16 to 30, 1892	35.00
16	22	Geo. H. Eldridge	Traveling expenses	79.85
16	23	......do	Field expenses	19.66
22	24	Wm. K. Caskey	Care of horse	12.00
22	25	Keuffel & Esser Co	Drawing paper	20.80
22	26	H. B. Kummel	Services	8.33
22	27	W. S. Bayley	Services, April, 1892	40.00
22	28	......do	Services, May, 1892	75.00
22	29	L. S. Griswold	......do	65.32
22	30	......do	Traveling expenses	45.12
29	31	J. B. Woodworth	......do	39.33
29	32	W. M. Davis	......do	19.33
29	33	Cyrus C. Babb	Field expenses	10.00
30	34	Raphael Pumpelly	Services, June, 1892	329.70
30	35	J. T. Masten	Forage	30.00
30	36	Wm. K. Caskey	......do	3.50
30	37	W. Lockhart & Co	Box for microscope	8.00
30	38	......do	......do	8.00

Abstract of disbursements made by C. D. Davis, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
June 30	39	Wm. Orr, jr	Services	$3.00
30	40	W. M. Davis	Services. June, 1892	33.00
30	41	W. P. Jenney	do	181.30
30	42	W. Lindgren	do	148.30
30	43	Lawrence C. Johnson	do	115.40
30	44	I. C. Russell	do	197 80
30	45	J. S. Diller	do	197.80
30	46	Pay roll of employés	do	1,071.45
30	47	do	do	2,973.75
30	48	T. Nelson Dale	do	164.80
30	49	M. R. Campbell	Traveling expenses	10.60
30	50	C. R. Van Hise	Services, June, 1892	329.70
30	51	Geo. H. Williams	do	130.00
30	52	J. M. Safford	do	69.20
30	53	J. A. Holmes	do	100.00
30	54	C. L. Whittle	do	100.00
30	55	Ben. G. Palmer	do	40.00
30	56	Richard Bliss	do	27.30
30	57	J. E. Spurr	do	8.00
30	58	J. E. Wolff	do	143.41
30	59	L. G. Westgate	do	50.00
30	60	Ben. K. Emerson	do	100.00
30	61	J. B. Woodworth	do	50.00
30	62	N. S. Shaler	do	260.00
30	63	Wm. J. Swinburne	Fuel	76.40
30	64	Herbert L. Dyer, agent	Rent of office	43.75
30	65	Newport Waterworks	Water rent	7.50
30	66	B. K. Emerson	Supplies	11.91
30	67	Providence Telephone Co	Services	11.50
30	68	Nathan Barker	Repairs	41.53
30	69	Geo. H. Chase	Photographer's supplies	14.50
30	70	do	do	23.13
30	71	Eastman Kodak Co	Reloading films, etc	41.25
30	72	Wm. K. Caskey	Board, etc	24.00
30	73	Geo. A. Lake	Leather cases	6.50
30	74	G. Freeborn Gilmore	do	10.00
30	75	do	do	30.00
		Total		8,788.00

Abstract of disbursements made by P. H. Christie, special disbursing agent, U. S. Geological Survey, during the fiscal year 1891-'92.

1891.				
July 15	1	Pay roll	Services, July, 1891	$94.25
15	2	do	do	85.06
15	3	do	do	101.60
15	4	K. R. Duniway	do	24.19
15	5	G. E. Hyde	do	48.91
15	6	W. M. Beaman	do	40.76
15	7	S. S. Gannett	Traveling expenses	25.48
15	8	Robert Muldrow	Services, July, 1891	48.91
15	9	do	Field expenses	81.50
15	10	H. M. Wilson	Services, July, 1891	101.90
15	11	J. H. Wheat	Traveling expenses	4.25
15	12	do	Services, July, 1891	36.68
15	13	Robert Muldrow	Traveling expenses	4.25
15	14	S. J. Haislett	Field material	189.00
15	15	do	do	24.00
15	16	G. E. Hyde	Field expenses	59.47
15	17	Dodge & Speece	Field supplies	78.97
15	18	Louis Nell	Traveling expenses	39.90
15	19	do	Field expenses	147.15
16	20	V. Schoonmaker	Field material	620.05
16	21	Geo. E. Kennedy & Sons	Field supplies	35.00
16	22	Thompson & Co	do	8.20
16	23	L. C. Fletcher	Field expenses	85.00
16	24	William J. Peters	do	91.11
16	25	Easton & Rupp	Field supplies	1.75
16	26	L. C. Fletcher	Field expenses	88.03
16	27	John J. Lincoln	Services, July, 1891	36.68
16	28	J. H. Jennings	do	65.22
16	29	A. B. Searle	do	40.76
17	30	Walter N. Beacher	Field material	245.00
17	31	A. B. Jones	Stock	100.00
17	32	E. C. Barnard	Field expenses	97.26
17	33	Edward Kübel	do	12.87
17	34	M. V. B. Copps	Field repairs	22.35

Abstract of disbursements made by P. H. Christie, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
July 17	35	W. H. Trexler	Field expenses	$6.00
17	36	J. T. Morgan	do	18.75
17	37	John W. Bostain	do	142.39
17	38	Smithdial, Taylor & Co	do	99.64
18	39	Emil Jonscher	Field material and repairs	192.35
18	40	Beckham & Corum	Forage and care of stock, July, 1891	5.50
18	41	M. Hackett	Services, July, 1891	88.04
18	42	J. H. Jennings	Field expenses	89.90
18	43	E. B. Clark	do	50.50
18	44	do	Services, July, 1891	57.07
18	45	James G. Reaves	Forage of stock	4.00
20	46	J. T. Morgan	Repairs to field material	16.60
20	47	M. Hackett	Field expenses	54.22
20	48	Louis Nell	do	118.65
21	49	Sparks Bros	Stock	175.00
22	50	John W. Bostain	Field supplies	18.70
22	51	W. M. Beaman	Field expenses	98.16
22	52	L. C. Fletcher	do	83.28
23	53	R. M. Towson	do	137.15
24	54	Glenn S. Smith	do	136.61
24	55	do	Traveling expenses	13.63
24	56	Van H. Manning	Field expenses	161.30
24	57	William J. Peters	do	87.03
24	58	J. W. Thom	do	42.00
24	59	Chattanooga Saddlery Co	Field material	68.65
24	60	Chas. E. Cooke	Traveling expenses	25.47
25	61	do	Field expenses	36.40
25	62	do	do	39.62
25	63	William M. Cunningham	Stock	85.00
29	64	H. M. Wilson	Services, July, 1891	108.70
29	65	Pay roll	do	414.04
29	66	do	do	340.60
29	67	do	do	243.70
29	68	do	do	308.70
29	69	do	do	285.90
29	70	D. C. Harrison	do	117.90
29	71	Wm. H. Griffin	do	75.80
29	72	Pay roll	do	536.20
29	73	do	do	519.30
30	74	do	do	370.47
30	75	M. Hackett	do	63.56
30	76	Pay roll	do	453.20
30	77	Chas. E. Cooke	do	117.90
30	78	Henry Gannett	do	303.30
30	79	Pay roll	do	90.74
30	80	do	do	108.39
31	81	do	do	372.20
31	82	do	do	1,536.40
31	83	Chas. M. Yeates	do	151.60
31	84	Pay roll	do	126.35
31	85	G. E. Hyde	do	52.19
31	86	W. M. Beaman	do	43.44
31	87	R. R. Duniway	do	25.81
31	88	John J. Lincoln	do	39.12
31	89	J. H. Jennings	do	69.58
31	90	J. W. Thom	do	70.80
31	91	J. H. Wheat	do	39.12
31	92	Robert Muldrow	do	52.19
31	93	E. B. Clark	do	60.83
31	94	Jas. McCormick	do	75.80
31	95	Frank Sutton	do	134.80
31	96	E. C. Ryan	do	60.00
31	97	G. L. Johnson	do	75.80
31	98	Eva Burke	do	25.00
31	99	Jasper Rogers	Stock	100.00
31	100	Van H. Manning, jr	Field expenses	147.50
31	101	L. C. Fletcher	do	106.75
31	102	W. F. Fling	Forage of stock	18.50
31	103	Eliza Payne	Services, July, 1891	18.55
31	104	F. H. Clark	do	22.25
31	105	R. D. Cummin	do	134.80
		Total		12.954.90
Aug. 3	1	Gilbert Thompson	Traveling expenses	18.60
17	2	A. B. Searle	Services, August 1 to 15, 1891	38.04
17	3	Chas. E. Cooke	do	57.07
17	4	E. B. Clarke	Field expenses	85.00
17	5	J. W. Thom	do	107.75
17	6	Jas. McCormick	do	101.25

Abstract of disbursements made by P. H. Christie, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Aug. 17	7	Robt. D. Cummin	Field expenses	$44.49
17	8	......do	Traveling expenses	11.92
17	9	Ewing Speed	......do	10.49
17	10	Glenn S. Smith	......do	27.88
17	11	......do	Field expenses	85.67
17	12	Frank Sutton	......do	169.39
17	13	G. E. Hyde	......do	64.75
17	14	W. M. Beaman	......do	148.21
17	15	M. B. Lambert	......do	179.10
17	16	J. H. Jennings	......do	107.20
17	17	M. Hackett	......do	105.47
17	18	Louis Nell	......do	205.14
17	19	E. C. Barnard	......do	233.83
17	20	Chas. E. Cooke	......do	59.51
17	21	L. C. Fletcher	......do	91.08
17	22	......do	......do	99.65
17	23	Van H. Manning, jr	......do	133.82
17	24	D. C. Harrison	......do	179.00
17	25	William J. Peters	......do	78.74
17	26	R. M. Towson	......do	74.55
17	27	H. B. Blair	......do	150.55
17	28	Geo. T. Hawkins	......do	19.60
17	29	......do	......do	11.85
17	30	......do	......do	147.91
17	31	......do	......do	87.50
17	32	N. B. Dunn	......do	28.85
17	33	John A. Bridgford	Stock	150.00
18	34	W. H. Linzy	Field material	78.70
18	35	W. S. Hutt	Field supplies	109.74
18	36	John M. Sawyers	Forage of stock	64.00
18	37	John W. Price	......do	9.00
18	38	James G. Bower	Freight	3.40
18	39	Robt. Muldrow	Traveling expenses	17.80
18	40	N. M. Peyton	Services, July, 1891	25.00
18	41	R. R. Duniway	Services, August 1 to 15, 1891	24.19
18	42	W. M. Beaman	......do	40.76
18	43	Pay roll	......do	117.94
19	44	H. M. Wilson	Traveling expenses	161.25
19	45	John H. Renshawe	......do	116.30
20	46	Clark & Matthews	Field supplies	91.11
20	47	R. D. Cummin	Field expenses	75.86
20	48	......do	......do	46.57
20	49	Wm. J. Peters	......do	116.49
20	50	R. M. Towson	......do	208.55
20	51	Henry Gannett	Traveling expenses	144.39
21	52	J. D. Lincoln	Services, August 1 to 15, 1891	34.24
21	53	Pay roll	......do	118.44
21	54	Robt. Muldrow	Field expenses	53.00
21	55	Sparks Bros	Stock	165.00
21	56	Louis Nell	Field expenses	165.69
21	57	L. C. Fletcher	......do	108.45
22	58	Geo. T. Hawkins	Traveling expenses	29.60
22	59	W. T. Quillin	......do	22.20
22	60	B. C. Washington, jr	......do	11.00
24	61	W. H. Lovell	Field expenses	120.00
24	62	......do	......do	54.00
25	63	E. C. Barnard	......do	141.90
26	64	Edward Kübel	......do	36.26
27	65	A. M. Walker	......do	46.75
31	66	Pay roll	Services, August, 1891	372.20
31	67	......do	......do	1,552.76
31	68	......do	......do	234.80
31	69	......do	......do	210.00
31	70	......do	......do	391.86
31	71	......do	......do	283.70
31	72	......do	......do	320.60
31	73	......do	......do	453.20
31	74	A. B. Searle	Services, August 1 to 15, 1891	43.44
31	75	Jno. H. Renshawe	Services, August, 1891	210.60
31	76	John J. Lincoln	......do	75.80
31	77	J. H. Jennings	......do	134.80
31	78	George E. Hyde	......do	101.10
31	79	H. M. Wilson	......do	210.60
31	80	Jno. H. Kapp	Stock	140.00
31	81	Eva Burke	Services, August, 1891	25.00
31	82	L. B. Wickershaw	......do	19.35
31	83	E. B. Clark	......do	117.90
31	84	J. W. Thom	......do	70.80
31	85	Pay roll	......do	519.30
31	86	......do	......do	532.40

Abstract of disbursements made by P. H. Christie, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Aug. 31	87	Pay roll	Services, August, 1891	$616.20
31	88	M. Hackett	Field expenses	107.82
31	89	......do	......do	95.51
31	90	A. B. Searle	Services, August 16 to 31, 1891	2.72
31	91	Eliza Payne	Services, August, 1891	25.00
31	92	Jas. McCormick	......do	75.80
31	93	Robert Muldrow	......do	101.10
31	94	W. M. Beaman	......do	43.44
31	95	R. R. Duniway	......do	25.81
31	96	Pay roll	......do	340.60
31	97	J. H. Jennings	Traveling expenses	61.49
31	98	Frank Sutton	Services, August, 1891	134.80
31	99	G. L. Johnson	......do	75.80
31	100	E. C. Ryan	......do	60.00
31	101	L. C. Fletcher	Field expenses	87.11
31	102	Van H. Manning, jr	......do	133.67
31	103	Pay roll	Services, August, 1891	126.36
31	104	......do	......do	125.76
31	105	Glenn S. Smith	......do	75.80
		Total		14,006.44
Sept. 3	1	Frank Howe & Son	Hire of transportation	80.65
4	2	Wm. H. Griffin	Services	75.80
4	3	D. C. Harrison	......do	117.90
4	4	Chas. E. Cooke	......do	60.83
4	5	Robt. D. Cummin	Field expenses	87.50
4	6	......do	......do	11.15
4	7	......do	......do	42.35
4	8	Chas. E. Cooke	......do	50.45
4	9	Chattanooga Saddlery Co	Field material	35.00
4	10	......do	......do	35.00
5	11	W. M. Beaman	Field expenses	263.22
5	12	Geo. T. Hawkins	......do	144.65
5	13	Louis Nell	......do	216.15
5	14	W. H. Lovell	......do	114.37
5	15	Jas. McCormick	......do	94.75
5	16	Frank Sutton	......do	283.44
5	17	Edward B. Aldrich	Traveling expenses	8.40
5	18	Ewing Speed	......do	9.70
5	19	Glenn S. Smith	......do	3.50
5	20	Robt. D. Cummin	......do	16.95
5	21	A. M. Walker	Field expenses	64.25
5	22	D. C. Harrison	......do	177.90
8	23	Jas. U. Goode	Services	55.00
8	24	Nannie M. Peyton	......do	25.00
9	25	R. M. Towson	Field expenses	79.85
9	26	L. C. Fletcher	......do	178.20
9	27	E. C. Barnard	......do	196.35
9	28	G. E. Hyde	......do	104.50
9	29	M. B. Lambert	......do	174.91
10	30	......do	Traveling expenses	6.36
10	31	Jas. U. Goode	......do	38.00
10	32	J. A. Jennings	Field expenses	135.97
10	33	H. B. Blair	......do	201.32
10	34	W. H. Lovell	......do	57.25
10	35	J. W. Thom	......do	60.25
10	36	E. B. Clark	......do	109.37
10	37	William J. Peters	......do	112.89
11	38	William J. Peters	......do	34.75
11	39	......do	......do	25.25
12	40	H. M. Wilson	......do	62.50
14	41	A. B. Searle	Traveling expenses	21.47
15	42	L. C. Fletcher	Field expenses	101.91
15	43	Van H. Manning, jr	......do	104.25
15	44	Robert Muldrow	......do	92.62
15	45	John H. Renshaw	Traveling expenses	71.56
17	46	J. H. Jennings	Field expenses	40.00
17	47	Charles E. Cooke	......do	60.85
17	48	V. Schoonmaker	Field material	30.00
18	49	W. M. Beaman	Field expenses	73.41
18	50	Louis Nell	......do	142.60
19	51	H. M. Wilson	Traveling expenses	140.43
19	52	Frank Howe & Son	Field expenses	85.00
19	53	Chris. Dawson	Traveling expenses	15.82
19	54	......do	......do	10.88
19	55	Robert D. Cummin	Field expenses	106.74
19	56	M. Hackett	......do	232.13
22	57	Van H. Manning, jr	......do	91.50
22	58	Walter N. Beecher	Field material	71.35

Abstract of disbursements made by P. H. Christie, etc.—Continued

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Sept. 22	59	John H. Renshawe	Traveling expenses	$42.74
22	60	R. M. Towson	Field expenses	205.80
22	61	L. C. Fletcher	do	67.41
25	62	A. E. Murlin	Traveling expenses	12.88
26	63	George T. Hawkins	do	18.80
26	64	Nat. G. Van Doren	do	30.71
26	65	George T. Hawkins	Field expenses	258.97
30	66	Charles E. Cooke	Services, September, 1891	114.20
30	67	Pay roll	do	1,682.80
30	68	do	do	360.60
30	69	do	do	506.40
30	70	do	do	237.60
30	71	do	do	363.20
30	72	do	do	350.60
30	73	do	do	215.40
30	74	E. B. Clark	do	114.20
30	75	J. W. Thom	do	68.40
30	76	R. Lee Longstreet	do	232.10
30	77	G. E. Hyde	do	97.80
30	78	J. H. Jennings	do	130.40
30	79	John J. Lincoln	do	73.40
30	80	W. M. Beaman	do	81.60
30	81	R. R. Duniway	do	43.33
30	82	D. C. Harrison	do	114.20
30	83	William H. Griffin	do	73.40
30	84	H. M. Wilson	do	203.80
30	85	Robert Muldrow	do	97.80
30	86	John H. Renshawe	do	203.80
30	87	C. G. Van Hook	do	97.80
30	88	Frank Sutton	do	130.40
30	89	G. L. Johnson	do	74.40
30	90	E. C. Ryan	do	60.00
30	91	L. B. Wickersham	do	25.00
30	92	Eva Burke	do	25.00
30	93	Pay roll	do	253.80
30	94	do	do	453.60
30	95	Gilbert Thompson	Traveling expenses	29.25
30	96	R. Lee Longstreet	do	29.25
30	97	Edward B. Aldrich	do	9.45
30	98	James S. Topham	Field material	7.50
30	99	H. M. Wilson	Traveling expenses	55.68
30	100	Pay-roll	Services, September, 1891	405.40
30	101	do	do	491.46
30	102	do	do	205.00
30	103	do	do	333.80
30	104	do	do	525.19
30	105	E. C. Barnard	Field expenses	165.67
		Total		14,473.14
Oct. 3	1	James McCormick	Services, September, 1891	73.40
3	2	Herbert G. Ogden, jr	do	80.00
3	3	Eliza Payne	do	25.00
3	4	Nannie M. Peyton	do	25.00
5	5	T. W. Clarke, jr.	do	3.22
5	6	L. C. Fletcher	Field expenses	98.85
5	7	R. Lee Longstreet	do	26.80
5	8	H. M. Wilson	do	34.25
5	9	Frank Sutton	do	343.00
5	10	Jas. McCormick	do	88.95
6	11	Robt. D. Cummin	do	109.62
6	12	Chas. E. Cooke	do	61.70
6	13	L. C. Fletcher	do	95.85
6	14	Louis Nell	do	170.46
6	15	D. C. Harrison	do	122.25
6	16	W. M. Beaman	do	109.86
6	17	J. H. Jennings	do	277.62
6	18	G. E. Hyde	do	82.71
6	19	Robert Muldrow	do	80.12
6	20	Robt. D. Cummin	do	117.33
7	21	M. B. Lambert	do	171.06
7	22	Henry Gannett	Traveling expenses	128.76
7	23	G. E. Hyde	do	19.00
7	24	M. B. Lambert	do	3.40
7	25	W. M. Beaman	do	9.57
7	26	Jas. McCormick	do	11.25
7	27	Glenn S. Smith	do	12.70
7	28	Robt. D. Cummin	do	19.56
8	29	W. T. Fling	Forage of stock	36.00
8	30	John W. Price	do	18.00

Abstract of disbursements made by P. H. Christie, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891. Oct. 8	31	Ocala Transfer Co	Storage	$15.00
12	32	W. H. Lovell	Field expenses	57.90
12	33	Van H. Manning, jr	......do	124.85
12	34	L. C. Fletcher	......do	104.90
12	35	William J. Peters	......do	39.50
12	36	E. C. Barnard	......do	222.54
12	37	R. M. Towson	......do	81.25
15	38	A. M. Walker	......do	19.40
15	39	D. S. Tweedy	......do	80.00
15	40	E. B. Clark	......do	164.49
15	41	J. W. Thom	......do	162.25
16	42	W. H. Lovell	......do	89.50
16	43	L. C. Fletcher	......do	81.80
16	44	......do	......do	113.40
16	45	Louis Nell	......do	159.23
22	46	L. C. Fletcher	Traveling expenses	101.75
22	47	Hersey Monroe	Field expenses	14.00
22	48	A. M. Walker	......do	47.75
23	49	W. M. Beaman	......do	75.98
23	50	A. F. Dudley	Traveling expenses	6.84
23	51	J. W. Thom	......do	4.12
23	52	R. R. Duniway	......do	26.39
23	53	T. W. Clarke, jr	......do	21.75
23	54	William J. Peters	Field expenses	57.10
23	55	H. B. Blair	......do	221.52
23	56	William J. Peters	......do	89.05
24	57	Van H. Manning, jr	......do	111.95
26	58	W. E. Lackland	Traveling expenses	42.40
26	59	Henry Gannett	......do	57.70
26	60	S. A. Aplin	......do	50.95
26	61	John Noonan	Field expenses	30.00
26	62	M. Hackett	......do	332.42
26	63	W. H. Lovell	......do	31.70
26	64	Geo. T. Hawkins	......do	257.33
31	65	Robert Muldrow	Services, October, 1891	101.10
31	66	E. B. Clark	......do	117.90
31	67	J. W. Thom	......do	70.80
31	68	Pay roll	......do	340.60
31	69	Nannie M. Peyton	......do	12.90
31	70	Pay roll	......do	334.00
31	71	L. B. Wickersham	......do	25.00
31	72	A. E. Murlin	......do	134.80
31	73	Harrison E. Crook	......do	70.80
31	74	H. L. Baldwin, jr	......do	151.60
31	75	Hersey Monroe	......do	101.10
31	76	L. C. Fletcher	......do	151.60
31	77	R. Lee Longstreet	......do	117.90
31	78	Jno. H. Renshawe	......do	210.60
31	79	Pay roll	......do	372.20
31	80	......do	......do	1,561.70
31	81	J. H. Jennings	......do	134.80
31	82	Frank Sutton	......do	134.80
31	83	Glenn S. Smith	......do	75.80
31	84	G. L. Johnson	......do	75.80
31	85	G. E. Hyde	......do	101.10
31	86	W. M. Beaman	......do	84.20
31	87	John J. Lincoln	......do	75.80
31	88	Pay roll	......do	194.80
31	89	......do	......do	181.60
31	90	Clifford Arrick	......do	101.10
31	91	Pay roll	......do	370.90
31	92	......do	......do	313.70
31	93	......do	......do	432.40
31	94	Geo. H. McKeehan	......do	60.00
31	95	W. E. Lackland	......do	70.80
31	96	Chas. E. Cooke	......do	117.90
31	97	D. C. Harrison	......do	117.90
31	98	Wm. H. Griffin	......do	75.80
31	99	Pay roll	......do	609.80
31	100	......do	......do	193.70
31	101	R. M. Towson	Field expenses	109.35
31	102	Pay roll	Services	545.40
31	103	Hersey Munroe	Field expenses	20.75
31	104	E. C. Ryan	Traveling expenses	6.40
31	105	H. L. Baldwin, jr	......do	55.50
		Total		13,686.70
Nov. 2	1	James McCormick	Services, October, 1891	75.80
2	2	Robert D. Cummin	......do	134.80

Abstract of disbursements made by P. H. Christie, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Nov. 2	3	Hersey Munroe	Traveling expenses	$8.65
2	4	A. F. Dudley	do	13.66
4	5	J. H. Jennings	Field expenses	217.15
4	6	A. F. Dudley	do	48.75
4	7	Charles E. Cooke	do	78.06
4	8	E. C. Barnard	do	202.46
5	9	D. C. Harrison	do	123.75
5	10	Van H. Manning, jr	do	85.00
6	11	James McCormick	do	100.06
6	12	Van H. Manning, jr	Traveling expenses	49.90
7	13	Isaac Crump	Forage of stock	38.32
7	14	Van H. Manning, jr	Traveling expenses	26.50
7	15	W. H. Lovell	Field expenses	74.50
7	16	G. E. Hyde	do	63.84
7	17	A. M. Walker	do	31.44
10	18	G. W. Shuler	Storage	6.00
10	19	W. F. Fling	Forage	18.00
10	20	John W. Price	do	9.00
10	21	George H. McKeehan	Traveling expenses	17.75
10	22	A. C. Wilson	do	24.63
11	23	J. E. McDaniel	Storage	5.00
11	24	A. E. Murlin	Field expenses	30.85
11	25	do	do	17.50
12	26	J. H. Jennings	do	62.75
12	27	D. S. Tweedy	do	80.00
12	28	W. O. Beall	Traveling expenses	29.90
13	29	Louis Nell	Field expenses	216.61
14	30	Charles E. Cooke	do	55.55
16	31	H. B. Blair	do	216.85
18	32	H. L. Baldwin, jr	do	39.25
18	33	R. M. Towson	do	141.35
19	34	M. B. Lambert	do	150.05
19	35	E. C. Barnard	do	55.00
19	36	do	do	263.70
19	37	M. B. Lambert	Traveling expenses	14.65
19	38	Glenn S. Smith	do	37.97
19	39	B. Peyton Legaré	do	27.00
19	40	do	do	17.40
20	41	Jno. H. Renshawe	do	210.54
20	42	Frank Sutton	Field expenses	341.49
23	43	A. M. Jackson	Traveling expenses	9.60
23	44	do	do	20.75
23	45	Robert Muldrow	do	15.40
23	46	Rob't D. Cummin	do	23.92
23	47	E. B. Clark	do	12.05
23	48	John J. Lincoln	po	49.14
23	49	Robert Muldrow	Field expenses	175.25
23	50	Rob't D. Cummin	do	194.61
23	51	E. B. Clark	do	192.50
23	52	Geo. T. Hawkins	do	218.62
24	53	R. Lee Longstreet	do	105.40
24	54	J. W. Thom	do	48.90
24	55	do	Traveling expenses	12.05
24	56	J. H. Jennings	do	24.16
24	57	R. Lee Longstreet	do	24.35
24	58	Jas. McCormick	do	19.59
24	59	W. M. Beaman	Field expenses	93.79
24	60	do	Traveling expenses	29.67
30	61	Pay roll	Services, November, 1891	454.20
30	62	do	do	425.20
30	63	do	do	844.20
30	64	do	do	1,098.80
30	65	do	do	360.60
30	66	do	do	2,110.00
30	67	J. H. Jennings	do	130.40
30	68	Chas. M. Yates	do	146.80
30	69	A. E. Murlin	do	130.40
30	70	Hersey Munroe	do	97.80
30	71	H. L. Baldwin, jr	do	146.80
30	72	G. E. Hyde	Traveling expenses	29.54
30	73	William J. Peters	do	55.25
30	74	Nat. Tyler, jr	do	48.75
30	75	William J. Peters	Field expenses	86.83
30	76	do	do	172.01
30	77	M. Hackett	do	190.44
30	78	Pay roll	Services, November, 1891	527.00
30	79	J. L. Bowdre	do	50.00
30	80	F. Howard Seely	Traveling expenses	16.75
		Total		11,852.95

Abstract of disbursements made by P. H. Christie, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891				
Dec. 4	1	Pay roll	Services, November, 1891	$375.00
4	2	Chas. E. Cooke	Field expenses	60.60
4	3	Hersey Munroe	Traveling expenses	32.30
5	4	A. M. Walker	Services, November, 1891	60.00
5	5	Pay roll	do	313.20
7	6	do	do	317.00
7	7	Basil Duke	Traveling expenses	48.75
7	8	G. L. Johnston	do	38.13
7	9	Chas. E. Cooke	do	25.72
7	10	J. L. Bowdre	do	21.92
8	11	C. W. Goodlove	do	67.00
8	12	Wm. H. Griffin	do	38.87
8	13	D. C. Harrison	do	34.87
8	14	Frank Sutton	do	35.67
8	15	R. M. Towson	do	22.42
8	16	William Smith	do	38.79
9	17	Pay roll	Services	20.32
9	18	H. B. Blair	Traveling expenses	44.60
9	19	A. B. Searle	do	44.60
9	20	C. W. Goodlove	Field expenses	24.75
9	21	W. H. Lovell	do	30.00
10	22	R. M. Towson	do	26.20
10	23	A. M. Walker	do	10.50
10	24	D. C. Harrison	do	42.50
10	25	R. M. Towson	do	189.25
10	26	W. H. Lovell	Traveling expenses	24.90
10	27	A. M. Walker	do	27.20
11	28	F. P. Metzger	do	33.75
11	29	W. L. Miller	do	93.56
11	30	W. M. Crim	do	12.85
11	31	J. W. Thom	Field expenses	5.25
11	32	H. B. Blair	do	28.85
11	33	A. M. Jackson	Services	6.45
11	34	L. B. Wickersham	do	25.00
12	35	John W. Price	Forage of stock	30.00
12	36	C. G. Hamilton	do	53.26
12	37	E. A. Hagerty	do	11.60
12	38	M. Hackett	Traveling expenses	25.15
14	39	H. B. Blair	Field expenses	228.55
14	40	E. M. Blachly	Traveling expenses	7.25
14	41	S. E. Cook	do	16.40
14	42	E. C. Barnard	do	75.42
15	43	W. C. Frye	Services	29.35
15	44	M. Hackett	Field expenses	281.35
16	45	E. C. Barnard	do	411.50
16	46	H. L. Baldwin, jr	do	136.82
16	47	do	Traveling expenses	84.85
16	48	E. M. Searle	Services	2.90
16	49	Isaac Crump	Forage of stock	66.00
17	50	Louis Nell	Field expenses	246.62
18	51	Thomas Gwyn	Traveling expenses	18.02
21	52	Robert H. Partridge	do	34.30
21	53	Geo. H. McKeehan	do	4.80
22	54	A. E. Murlin	do	88.57
22	55	Albert L. Montfredy	do	27.35
22	56	M. Hackett	Field expenses	84.10
22	57	Henry Ulke, jr	Traveling expenses	24.55
26	58	W. F. Fling	Forage of stock	12.00
26	59	Robt. H. Partridge	Field expenses	62.67
29	60	W. C. Frye	do	101.70
29	61	do	Traveling expenses	26.47
30	62	do	Services, December, 1891	46.45
30	63	Albert L. Montfredy	do	50.00
31	64	Robert H. Partridge	do	60.00
31	65	Pay roll	do	1,903.10
31	66	do	do	1,553.70
31	67	do	do	2,046.70
31	68	do	do	741.30
31	69	do	do	372.20
31	70	Louis Nell	do	168.50
31	71	C. G. Hamilton	Forage of stock	94.00
31	72	Geo. T. Hawkins	Services, December, 1891	134.80
31	73	B. C. Washington, jr	do	101.10
31	74	B. C. Washington, jr	Traveling expenses	44.70
31	75	Edward Kübel	Field expenses	12.66
31	76	Robert H. Partridge	do	80.00
31	77	Louis Nell	Traveling expenses	27.25
31	78	C. G. Van Hook	do	27.77
31	79	Louis Nell	Field expenses	127.75
31	80	M. Hackett	do	5.53

Abstract of disbursements made by P. H. Christie, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Dec. 31	81	Louis Nell	Field expenses	$83.80
31	82	Geo. T. Hawkins	do	238.85
31	83	do	Traveling expenses	46.45
31	84	Thomas Gwyn	Services	12.42
31	85	J. H. Hagerty	do	10.16
31	86	W. T. Walker	do	36.29
31	87	Geo. Unsell	do	36.13
31	88	R. C. Hemphill	Storage	3.60
31	89	Isaac Crump	Forage of stock	66.00
31	90	G. W. Shuler	Freight and storage	9.54
		Total		12,553.07
1892.				
Jan. 7	1	L. W. Sherman	Pencil sharpener	1.50
12	2	Louis Nell	Field expenses	145.73
12	3	do	do	172.66
12	4	N. B. Dunn	Forage of stock	127.30
12	5	W. F. Fling	do	38.52
12	6	R. R. Skees & Son	Storage	8.00
12	7	J. H. Hagerty	Forage of stock	41.59
13	8	F. T. Hagerty	Services	30.00
13	9	I. M. Buell	do	38.00
13	10	J. M. Lyle	Forage of stock	8.45
14	11	P. H. Christie	Traveling expenses	35.26
14	12	John W. Price	Forage of stock	30.00
21	13	Louis Nell	Field expenses	16.77
22	14	J. R. Bredin	do	5.00
25	15	W. A. Pelat	Storage	15.00
28	16	I. M. Buell	Traveling expenses	7.18
30	17	Pay roll	Services, January, 1892	749.40
30	18	do	do	376.40
30	19	do	do	2,333.80
30	20	do	do	1,923.30
30	21	do	do	1,671.70
		Total		7,775.56
Feb. 2	1	Robert H. Partridge	Services, January, 1892	60.00
4	2	Isaac Crump	Forage of stock	66.00
4	3	W. F. Fling	do	42.00
4	4	C. G. Hamilton	do	94.00
5	5	Robert H. Partridge	Field expenses	57.94
6	6	H. B. Blair	Services	65.93
8	7	N. B. Dunn	Forage of stock	162.00
8	8	J. M. Lyle	Forage of stock, etc	28.25
11	9	J. H. Hagerty	Forage of stock	75.00
11	10	Geo. F. Wightman	Services, January, 1892	75.00
13	11	J. M. Gibson	Forage of stock	36.90
29	12	H. M. Wilson	Traveling expenses	34.10
29	13	Pay roll	Services, February, 1892	2,167.40
29	14	do	do	1,803.40
29	15	do	do	1,699.00
29	16	do	do	701.20
29	17	do	do	247.00
29	18	Robert H. Partridge	do	60.00
29	19	Isaac Crump	Forage of stock	66.00
29	20	C. G. Hamilton	do	94.00
29	21	J. H. Hagerty	do	75.00
		Total		7,710.12
Mar. 5	1	H. L. Baldwin, jr	Traveling expenses	49.20
5	2	Judson D. Lincoln	do	9.25
5	3	A. B. Searle	do	9.75
7	4	N. B. Dunn	Forage of stock	159.67
7	5	W. F. Fling	do	42.00
7	9	John W. Price	do	47.58
9	7	H. L. Baldwin, jr	Field expenses	55.73
10	8	Geo. F. Wightman	Services	18.00
16	9	H. L. Baldwin, jr	Field expenses	65.60
24	10	do	do	91.75
24	11	do	Traveling expenses	60.95
24	12	A. M. Walker	do	43.70
24	13	P. H. Christie	do	71.43
31	14	A. J. Shuford	Storage	15.00
31	15	H. L. Baldwin, jr	Services, March, 1892	153.30
31	16	Robert H. Partridge	do	60.00
31	17	A. M. Walker	do	30.97
31	18	A. B. Searle	do	85.20
31	19	Judson D. Lincoln	do	71.50
31	20	Pay roll	do	264.00

Abstract of disbursements made by P. H. Christie, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
Mar. 31	21	Pay roll	Services, March, 1892	$749.40
31	22	......do	......do	1,662.95
31	23	......do	......do	1,939.02
31	24	......do	......do	1,354.68
31	25	R. R. Skees & Son	Storage	9.00
31	26	Isaac Crump	Forage of stock	66.00
31	27	H. L. Baldwin, jr	Field expenses	77.25
		Total		7,262.88
Apr. 1	1	C. G. Hamilton	Forage and storage	94.00
1	2	J. H. Hagerty	Forage	75.00
12	3	Robert H. Partridge	Field expenses	48.75
12	4	N. B. Dunn	Forage of stock	117.00
12	5	W. F. Fling	......do	42.00
12	6	G. W. Shuler	Storage	6.00
12	7	C. V. Voils	......do	6.00
12	8	R. C. Hemphill	......do	9.00
12	9	E. C. Wills	......do	20.70
14	10	H. L. Baldwin, jr	Field expenses	91.30
15	11	......do	Traveling expenses	169.60
15	12	Pay roll	Services	49.38
25	13	T. C. McDaniel	Storage	10.00
30	14	Pay roll	Services, April, 1892	725.20
30	15	......do	......do	255.50
30	16	......do	......do	1,488.40
30	17	......do	......do	1,950.66
30	18	......do	......do	1,109.97
30	19	Robt. H. Partridge	......do	60.00
30	20	H. M. Wilson	Traveling expenses	24.30
30	21	C. G. Hamilton	Forage of stock and storage	96.85
30	22	J. H. Hagerty	Forage of stock	70.00
		Total		6,519.61
May 3	1	James S. Topham	Field material	19.50
4	2	Robert H. Partridge	Field expenses	110.55
5	3	B. B. Chase	......do	3.00
6	4	Isaac Crump	Forage of stock	66.00
9	5	Robert H. Partridge	Traveling expenses	9.45
12	6	W. F. Fling	Forage of stock	42.00
25	7	N. B. Dunn	......do	117.00
31	8	A. J. Bradfield	......do	25.74
31	9	Robert H. Partridge	Services, May, 1892	60.00
31	10	F. P. Metzger	......do	54.40
31	11	Judson D. Lincoln	......do	71.60
31	12	Pay roll	......do	749.60
31	13	......do	......do	264.00
31	14	......do	......do	1,166.60
31	15	......do	......do	894.60
31	16	......do	......do	1,920.00
31	17	......do	......do	655.60
		Total		6,229.64
June 1	1	C. G. Hamilton	Forage of stock	94.00
2	2	W. A. Brent	......do	30.76
9	3	Robert H. Partridge	Field expenses	138.15
13	4	Isaac Crump	Forage of stock	66.00
15	5	J. H. Hagerty	......do	75.00
15	6	N. B. Dunn	......do	117.00
15	7	P. H. Christie	Traveling expenses	34.39
20	8	H. M. Wilson	......do	67.81
21	9	Edward Kübel	Material and repairs	99.70
30	10	G. L. Johnson	Services, June, 1892	74.20
30	11	Hersey Munroe	......do	98.90
30	12	Robert H. Partridge	......do	60.00
30	13	E. C. Wills	Storage	18.00
30	14	N. B. Dunn	Forage of stock	117.00
30	15	R. R. Skees & Son	Storage	9.00
30	16	R. C. Hemphill	......do	9.00
30	17	C. V. Voils	......do	6.00
30	18	G. W. Shuler	......do	6.00
30	19	C. G. Hamilton	Forage of stock	94.00
30	20	Isaac Crump	......do	66.00
30	21	J. H. Hagerty	......do	75.00
30	22	Pay roll	Services, June, 1892	263.70
36	23	......do	......do	189.60
30	24	......do	......do	305.00
30	25	......do	......do	291.70

Abstract of disbursements made by P. H. Christie, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
June 30	26	Pay roll	Services, June, 1892	$274.30
30	27	A. J. Shuford	Storage	15.00
30	28	A. E. Murlin	Traveling expenses	2.25
30	29	S. L. Moore	Storage	14.00
30	30	Robert H. Partridge	Traveling expenses	9.55
80	31	Pay roll	Services, June, 1892	2,047.10
30	32	......do	......do	1,397.10
30	33	......do	......do	733.50
30	34	......do	......do	560.40
30	35	......do	......do	255.50
30	36	J. J. Lafargne	Storage	12.00
30	37	W. A. Brent	Forage of stock	46.00
30	38	Hersey Munroe	Field expenses	3.50
30	39	Robert H. Partridge	......do	151.88
30	40	T. C. McDaniel	Storage	5.00
30	41	J. W. Hill	......do	42.00
		Total		7,974.99

Abstract of disbursements made by James W. Spencer, special disbursing agent, U. S. Geological Survey, during the fiscal year 1891-'92.

1891.				
July 17	1	Willard D. Johnson	Traveling expenses	$32.90
17	2	......do	Field expenses	10.25
17	3	C. C. Bassett	......do	80.35
17	4	Robt. A. Farmer	......do	36.65
17	5	Paul Holman	......do	17.05
17	6	H. E. Clermont Feusier	......do	11.15
17	7	E. M. Douglas	......do	16.55
17	8	......do	......do	62.00
17	9	A. F. Dunnington	......do	50.95
17	10	A. P. Davis	......do	99.43
17	11	C. Becker	Field supplies	25.25
17	12	Jas. S. Topham	......do	5.00
17	13	The Coffin & Northrop Co	Subsistence	255.10
17	14	......do	......do	102.04
17	15	Chas. Himrod	......do	204.08
17	16	W. F. Flournoy	......do	88.05
17	17	Frank Frates	......do	53.61
17	18	C. F. Francisco	......do	198.00
17	19	Albany Hotel	Board	16.50
17	20	......do	......do	18.00
17	21	A. F. Terrill	......do	8.00
17	22	John R. Brennan	......do	4.50
17	23	W. B. Pullin	Forage	92.22
17	24	A. N. Johnson	......do	3.37
17	25	Dan Ferguson	Transportation	12.00
17	26	Fauth & Co	Instruments	101.75
20	27	J. S. J. Lillie	Repairs	3.00
20	28	Olcese & Garribaldi	Forage	100.00
20	29	David P. Long	......do	9.54
20	30	Stevens & Derby	Subsistence	3.90
20	31	......do	......do	9.36
20	32	Redick H. McKee	Field expenses	73.08
20	33	Perry Fuller	......do	26.80
21	34	Alex. C. Barclay	......do	123.87
21	35	E. T. Perkins, jr	......do	63.85
21	36	A. F. Dunnington	......do	83.75
21	37	H. E. Clermont Feusier	......do	24.75
21	38	S. H. Pullin	......do	6.85
21	39	Schwartz & Raas	Field supplies	78.85
21	40	D. N. Johnson	Forage	19.50
21	41	Daniel Nevitt	Subsistence	15.75
21	42	Hotel Templeton	......do	94.50
22	43	Hammond & Bates	......do	46.70
22	44	Coffin & Seeton	Forage	194.76
22	45	M. P. Henderson & Son	Repairs	72.25
22	46	F. A. Silva	Field expenses	19.25
22	47	H. E. Clermont Feusier	......do	43.32
22	48	R. H. Chapman	......do	15.40
26	49	Nichols & Yager	......do	26.25
26	50	Wm. H. Herron	......do	23.50
26	51	R. O. Gordon	......do	132.15
26	52	E. M. Douglas	......do	45.20
26	53	Perry Fuller	......do	21.50
26	54	R. U. Goode	......do	40.50
26	55	......do	Traveling expenses	25.25

Abstract of disbursements made by James W. Spencer, etc.—Continued

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
July 26	56	New Alamo Hotel	Subsistence	$18.75
26	57	Daniel Nevitt	do	3.00
26	58	do	do	4.50
26	59	A. H. Thompson	Traveling expenses	91.22
28	60	S. C. Crawshaw	Subsistence	32.50
28	61	Elliott & Co	do	95.18
28	62	Clark Bros	do	14.10
28	63	Walt M. Priest	Transportation	16.50
28	64	William Spielman	Forage	12.50
28	65	R. P. Conant	do	29.24
28	66	do	do	19.07
28	67	E. A. Palm	Field supplies	6.43
28	68	Holcomb & Whitney	do	18.48
28	69	S. C. Gallup	do	4.00
28	70	Overpick Bros	do	85.25
28	71	J. E. Wilson	do	7.40
29	72	A. F. Dunnington	Field expenses	56.60
28	73	Redick H. McKee	do	21.05
28	74	H. E. Clemont Feusier	do	65.20
28	75	C. H. Pitch	do	57.31
28	76	Stuart P. Johnson	do	14.24
28	77	T. E. Grafton	do	29.90
28	78	R. B. Marshall	do	60.46
29	79	Stevenson Bros	Field supplies	121.32
29	80	do	Forage	25.00
29	81	Wm. J. Hales	do	225.00
29	82	Pay roll	Services, July, 1891	290.60
29	83	do	do	747.49
29	84	do	do	735.42
29	85	do	do	235.80
29	86	R. H. Chapman	do	134.80
29	87	H. H. Hackett	do	54.25
29	88	S. McDowell	Forage	300.00
29	89	E. A. Stuart	Subsistence	279.80
29	90	Pay roll	Services, July, 1891	301.60
29	91	do	do	240.00
30	92	do	do	374.80
30	93	do	do	105.00
30	94	do	do	165.80
30	95	do	do	258.50
31	96	do	do	328.83
31	97	do	do	224.20
31	98	do	do	309.20
31	99	do	do	251.10
31	100	do	do	144.20
31	101	do	do	290.60
31	102	do	do	256.10
31	103	do	do	319.00
31	104	do	do	352.90
31	105	do	do	257.90
31	106	do	do	262.90
31	107	James J. Shumway	do	50.00
31	108	R. U. Goode	do	210.60
31	109	Chas. Coffie	do	20.00
31	110	Sparks Bros	Transportation	1,150.00
31	111	Robert A. Farmer	Field expenses	55.12
31	112	Morris Bien	do	75.22
31	113	do	Traveling expenses	17.25
31	114	C. H. Stone	do	36.85
31	115	Pay roll	Services, July, 1891	98.71
31	116	John D. Paulsen	Transportation	14.49
31	117	R. G. S. Facio	Field expenses	23.00
31	118	Pay roll	Services, July, 1891	653.90
31	119	John M. C. Patton	do	6.77
31	120	Coffin & Secton	Forage	32.07
31	121	Paul Holman	Field expenses	96.40
31	122	R. U. Goode	do	51.75
31	123	W. H. Cadwell	do	56.30
31	124	R. G. S. Facio	do	27.00
31	125	H. E. Clermont Feusier, jr	do	25.00
31	126	Thomas S. Clark	Traveling expenses	12.50
31	127	Pay roll	Services, July, 1891	159.20
31	128	E. W. Reid	do	11.61
31	129	W. F. Borders	Forage	40.50
31	130	Perry Fuller	do	7.00
31	131	Reddick H McKee	Field expenses	41.30
31	132	A. F. Dunnington	do	57.65
31	133	R. B. Marshall	do	57.34
31				
		Total		14,490.65

Abstract of disbursements made by James W. Spencer, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Aug. 5	1	A. H. Thompson	Traveling expenses	$115.35
5	2	Pay roll, Tweedy	Services, July, 1891	831.60
5	3	Pay roll, Trowbridge	do	290.00
5	4	Jas. T. Storrs	do	17.74
12	5	Jas. W. Spencer	Traveling expenses	35.53
20	6	E. Holekamp	Field supplies	74.85
20	7	E. M. Douglass	Field expenses	48.14
20	8	do	do	34.12
20	9	do	do	83.35
20	10	Jeremiah Ahern	do	43.85
20	11	J. B. Lippincott	do	32.77
20	12	Williard D. Johnson	do	95.75
20	13	William S. Post	do	103.20
20	14	Charles F. Urquhart	do	184.88
20	15	H. S. Wallace	do	18.50
20	16	Frank Tweedy	do	69.15
20	17	C. H. Stone	do	18.79
20	18	A. P. Davis	do	79.07
20	19	C. H. Fitch	do	83.50
20	20	R. C. McKinney	do	144.30
20	21	C. C. Bassett	do	25.70
20	22	Alex C. Barclay	do	98.75
20	23	Stuart P. Johnson	do	51.89
20	24	C. P. McCary	do	4.50
20	25	W. T. Griswold	do	41.37
20	26	Sparks Bros	do	28.40
20	27	Robert A. Farmer	do	60.13
20	28	R. G. S. Facio	do	23.00
20	29	John Stromberg	do	19.40
20	30	E. T. Perkins, jr	do	38.30
20	31	Perry Fuller	do	22.50
20	32	Morris Bien	do	119.60
20	33	Mrs. A. L. Gooding	Subsistence	10.00
20	34	J. W. Green	do	35.00
20	35	Flounoy Bros	do	109.05
20	36	W. A. Morrow	do	27.50
20	37	The Denver Transit and Warehouse Co.	Storage	20.00
20	38	Willard D. Johnson	Services, July, 1891	168.50
20	39	John Moloney	do	31.50
20	40	E. E. Mudd	do	4.00
21	41	J. W. Heather	Subsistence	10.00
21	42	Robt. A. Farmer	Field expenses	70.14
21	43	E. M. Douglass	do	25.60
21	44	Reddick H. McKee	do	31.65
21	45	H. E. Clermont Feusier	do	43.00
24	46	Reddick H. McKee	do	29.72
24	47	E. M. Douglass	do	54.83
24	48	do	do	49.95
24	49	R. C. McKinney	do	44.58
24	50	E. T. Perkins, jr	do	35.75
24	51	R. B. Marshall	do	56.36
24	52	Coxhead & Harrel	do	49.50
24	53	H. J. Nichols	Forage	134.06
24	54	Hardin Campbell & Co	do	10.50
24	55	Isaac Engle	Transportation	65.00
25	56	Rudolph Pollitz	Subsistence	9.00
26	57	T. E. Grafton	Field expenses	16.80
26	58	A. F. Dunnington	do	63.05
26	59	Wm. H. Herron	do	51.25
26	60	S. B. Smith	do	3.10
26	61	do	do	5.40
26	62	O. T. Triplett	do	23.00
26	63	S. C. Crawshaw	do	5.00
26	64	Overpeck Bros	Field supplies	16.75
26	65	J. P. Waldron	Forage	41.00
26	66	E. Holekamp	do	76.85
26	67	E. A. Palm	do	8.00
26	68	R. P. Conant	do	11.17
26	69	H. S. Ballou	Subsistence	20.00
26	70	C. S. Minor	do	13.50
26	71	Walt M. Priest	Transportation	12.75
26	72	R. H. Chapman	Field expenses	30.25
26	73	R. H. Stewart	Subsistence	41.62
26	74	S. C. Gallup	Field expenses	1.50
26	75	W. T. Griswold	do	53.42
26	76	Younger & Roberts	Forage	18.00
28	77	Paul Holman	Field expenses	74.97
28	78	Alex McPhail	Subsistence	14.50
28	79	W. E Matthews	do	13.50

Abstract of disbursements made by James W. Spencer, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891. Aug. 28	80	Geo. Morrisson	Subsistence	$45.00
28	81	John D. Paulsen	Transportation	50.00
26	82	A. H. Thompson	Traveling expenses	152.85
28	83	Robert A. Farmer	Field expenses	58.80
28	84	Fred Bartles	Transportation	40.00
31	85	Morris Bien	Field expenses	60.62
25	86	R. U. Goode	Services, August 1, 1891	210.60
25	87	Pay roll	do	165.80
28	88	do	do	258.50
26	89	do	do	105.00
31	90	do	do	301.60
31	91	do	do	285.80
31	92	do	do	482.30
31	93	do	do	315.60
31	94	do	do	382.90
31	95	do	do	516.40
31	96	do	do	228.66
31	97	do	do	344.80
31	98	do	do	146.10
31	99	do	do	231.12
31	100	do	do	272.90
31	101	do	do	309.20
31	102	do	do	251.10
31	103	do	do	154.20
31	104	do	do	335.80
31	105	do	do	379.80
31	106	do	do	224.20
31	107	do	do	159.20
31	108	do	do	365.12
31	109	do	do	290.00
31	110	do	do	281.60
31	111	do	do	256.10
31	112	do	do	264.20
31	113	do	do	290.60
31	114	do	do	257.90
31	115	E. M. Douglass	do	168.50
31	116	Willard D. Johnson	do	168.50
31	117	P. V. S. Bartlett	do	84.20
31	118	J. M. Dikeman	do	75.00
31	119	H. H. Hackett	do	54.25
		Total		13,203.37
Sept. 7	1	A. H. Thompson	Traveling expenses	98.85
12	2	J. C. Foulks	do	79.25
12	3	W. P. Powell	do	24.00
12	4	Willard D. Johnson	Field expenses	35.50
12	5	Morris Bien	do	345.65
12	6	R. O. Gordon	do	141.80
12	7	H. S. Wallace	do	16.95
12	8	Wm. H. Herron	do	53.00
12	9	Perry Fuller	do	25.60
12	10	Charles T. Urquhart	do	210.29
12	11	Robert A. Farmer	do	39.95
12	12	do	do	49.95
12	13	C. H. Stone	do	31.55
12	14	C. H. Fitch	do	136.43
12	15	Frank Tweedy	do	100.98
12	16	R. B. Marshall	do	62.22
12	17	E. M. Douglas	do	69.92
12	18	do	do	62.35
12	19	E. T. Perkins, jr	do	74.00
12	20	R. H. Chapman	do	55.40
12	21	C. C. Bassett	do	61.91
12	22	Wm. H. Otis	do	13.25
12	23	H. E. Clermont Feusier	do	23.85
12	24	do	do	24.75
12	25	Reddick H. McKee	do	47.52
12	26	Jeremiah Ahern	do	78.65
12	27	J. B. Lippincott	do	63.46
12	28	A. P. Davis	do	74.29
12	29	R. C. McKinney	do	242.65
12	30	E. Holekamp	Field supplies	86.93
12	31	Buford & George Imp. Co	do	103.05
12	32	Elliott & Co	Subsistence	27.51
12	33	E. E. Burgess	do	65.00
12	34	A. H. Huston	do	30.00
12	35	S. Ecker	do	46.25
12	36	Fred. A. Schmidt	Paper	10.80
12	37	Jackson & Co	Forage	24.03

Abstract of disbursements made by James W. Spencer, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Sept. 12	38	W. B. Pullen	Forage	$21.42
12	39	John C. Brunner	......do	26.25
12	40	Coxhead & Horrel	Storage	7.50
12	41	Denver Transit and Warehouse Co.	......do	20.00
12	42	J. H. Flemister	Transportation	10.00
12	43	Schwartz & Raas	Subsistence	103.15
12	44	Guy H. Nichols	......do	22.35
19	45	R. U. Goode	Traveling expenses	90.35
21	46	A. H. Thompson	......do	132.00
19	47	Reddick H. McKee	Field expenses	32.17
21	48	Stuart P. Johnson	......do	159.19
22	49	Sep. Ackerman	Services, July 1, 1891	12.00
23	50	J. L. Barnes & Co	Forage	17.25
23	51	Brumer & Head	......do	9.56
23	52	John Vantigue	Field expenses	15.00
23	53	Alex. C. Barclay	......do	192.18
23	54	John McConn	Traveling expenses	63.70
23	55	Frank E. Gove	......do	44.85
23	56	Albany Hotel	Subsistence	18.00
23	57	Wm. H. Otis	Field expenses	6.00
28	58	E. M. Douglas	......do	39.34
28	59	......do	Traveling expenses	46.30
30	60	R. U. Goode	Services, September, 1891	203.80
30	61	Willard D. Johnson	......do	163.00
28	62	Pay roll	......do	451.40
28	63	......do	......do	278.40
30	64	......do	......do	256.60
30	65	......do	......do	292.80
30	66	H. S. Wallace	......do	130.40
30	67	Pay roll	......do	323.73
30	68	Jas. W. Spencer	Traveling expenses	73.85
		Total		6,030.08
Oct. 3	1	A. H. Thompson	Traveling expenses	91.95
5	2	Pay roll	Services, September, 1891	283.80
5	3	......do	......do	276.80
5	4	......do	......do	252.80
5	5	......do	......do	221.60
5	6	......do	......do	156.60
5	7	......do	......do	395.12
5	8	......do	......do	147.80
5	9	......do	......do	340.40
5	10	......do	......da	270.66
5	11	......do	......do	352.00
5	12	......do	......do	173.40
5	13	......do	......do	105.00
5	14	......do	......do	381.80
5	15	......do	......do	261.60
5	16	......do	......do	384.20
5	17	......do	......do	375.40
5	18	......do	......do	178.40
5	19	......do	......do	254.20
5	20	......do	......do	253.00
5	21	E. M. Douglas	......do	163.00
5	22	P. V. S. Bartlett	......do	81.60
5	23	Frank E. Gove	......do	81.60
5	24	Wm. B. Lane	......do	50.00
5	25	John D. Paulsen	Transportation	20.00
5	26	Moore & Peak	......do	48.21
5	27	Robert Flourmann	Storage	6.00
5	28	The Denver Transit and Warehouse Co.	......do	20.00
5	29	Albany Hotel	Subsistence	27.00
5	30	Wm. Crout	......do	18.75
5	31	Spielman Brothers	......do	16.72
5	32	E. Holekamp	Field supplies	57.70
5	33	Thomas S. Clark	Traveling expenses	72.00
5	34	R. B. Marshall	......do	49.80
5	35	P. V. S. Bartlett	......do	37.25
5	36	......do	......do	52.30
5	37	W. T. Griswold	Field expenses	30.41
5	38	A. F. Dunnington	......do	118.20
5	39	Morris Bien	......do	68.15
5	40	Cyrus C. Babb	......do	111.50
5	41	......do	......do	135.00
5	42	T. E. Grafton	......do	139.46
5	43	R. H. Chapman	......do	23.15
5	44	Reddick H. McKee	......do	16.23

Abstract of disbursements made by James W. Spencer, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891. Oct. 5	45	H. E. Clermont Feusier	Field expenses	$61.35
5	46	Perry Fuller	do	24.50
5	47	Robt. A. Farmer	do	49.55
5	48	do	do	42.38
5	49	do	do	50.05
5	50	R. B. Marshall	do	49.90
5	51	Frank Tweedy	do	85.57
5	52	Stuart P. Johnson	do	74.40
5	53	do	do	28.00
5	54	R. O. Gordon	do	237.97
5	55	W. E. Wagner	do	10.00
5	56	Moore & Peak	do	26.49
5	57	W. M. Walker	do	7.50
5	58	O. G. Triplett	do	22.00
5	59	Wm. H. Otis	do	15.00
5	60	William H. Cadwell	do	30.98
9	61	Pay roll (Post)	Services, September, 1891	207.80
12	62	Morris Bien	Field expenses	247.75
12	63	do	do	230.95
12	64	R. C. McKinney	do	146.05
12	65	do	do	91.68
12	66	R. H. Chapman	do	49.50
12	67	J. M. Dikeman	do	34.50
12	68	A. F. Dunnington	do	158.15
12	69	Jeremiah Ahern	do	59.35
12	70	H. E. Clermont Feusier	do	46.95
12	71	do	do	22.00
12	72	R. B. Marshall	do	6.20
12	73	E. T. Perkins, jr	do	59.50
14	74	A. P. Davis	do	178.55
14	75	William S. Post	do	334.50
14	76	T. E. Grafton	do	21.10
14	77	Paul Holman	do	51.85
14	78	R. U. Goode	do	25.50
14	79	do	do	47.10
14	80	H. S. Wallace	do	24.25
14	81	Hardin, Campbell & Co	do	57.75
14	82	Cyrus C. Babb	do	26.00
14	83	E. M. Douglas	do	52.98
15	84	Perry Fuller	do	78.71
15	85	Wm. P. Trowbridge, jr	do	81.30
15	86	Alex C. Barclay	do	28.18
16	87	A. H. Thompson	Traveling expenses	93.00
17	88	Pay roll	Services, September, 1891	756.40
21	89	Jas. W. Spencer	Traveling expenses	82.30
23	90	Wm. B. Lane	Services, October, 1891	16.09
24	91	E. M. Douglas	Field expenses	92.86
27	92	do	Traveling expenses	110.20
26	92	Willard D. Johnson	do	132.05
27	94	C. C. Bassett	do	57.00
27	95	do	Field expenses	146.82
27	96	Morris Bien	do	238.05
27	97	Redick H. McKee	do	63.34
27	98	R. H. Chapman	do	35.95
27	99	A. F. Dunnington	do	39.15
27	100	do	do	105.60
27	101	H. E. Clemont Feusier	do	72.00
27	102	J. B. Lippincott	do	75.57
27	103	C. H. Stone	do	14.47
27	104	H. S. Wallace	do	28.45
27	105	C. H. Fitch	do	83.08
27	106	do	do	146.89
27	107	Robt. A. Farmer	do	59.50
27	108	Robt. A. Farmer	do	59.95
27	109	Stuart P. Johnson	do	101.00
27	110	Chas. F. Urquhart	do	160.70
27	111	P. V. S. Bartlett	do	69.47
27	112	Wm. H. Herron	do	40.00
27	113	T. E. Grafton	do	71.30
27	114	R. C. McKinney	do	63.19
27	115	Pay roll	Services, October, 1891	379.80
27	116	do	do	60.00
27	117	do	do	159.20
27	118	do	do	290.60
27	119	do	do	357.90
27	120	do	do	115.80
27	121	do	do	239.20
27	122	do	do	257.90
27	123	do	do	184.20
27	124	do	do	249.68

Abstract of disbursements made by James W. Spencer, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Oct. 27	125	Pay roll	Services, October, 1891	$502.80
27	126	......do	......do	315.60
27	127	C. C. Bassett	......do	117.90
27	128	C. H. Stone	......do	84.20
27	129	E. M. Douglas	......do	168.50
27	130	R. U. Goode	......do	210.60
27	131	A. H. Thompson	......do	252.70
27	132	Jas. W. Spencer	......do	151.60
27	133	L. C. Woodbury	......do	29.03
27	134	E. R. Kindle	......do	21.77
28	135	W. L. Kuykendall	Forage	16.00
28	136	C. M. Round	......do	17.50
28	137	H. J. Nichols	......do	31.68
28	138	Wm. Curtis	......do	11.25
28	139	J. P. Waldron	......do	23.65
28	140	C. E. Hutchinson	......do	16.07
28	141	Jackson & Co	......do	32.20
28	142	O'Neill & Co	Subsistence	31.76
28	143	Fred Waddleton	......do	7.00
28	144	Mrs. L. K. Rudolph	......do	10.50
28	145	Nils A. Bengson	......do	7.00
28	146	Krakaner. Zork & Moye	Field supplies	7.96
28	147	W. H. Shelton	......do	28.15
28	148	W. K. Fager	Field expenses	4.50
28	149	D. B. Hervey	......do	5.00
28	150	C. J. Hogerson	......do	7.00
28	151	J. F. Brown	......do	23.46
28	152	James B. Lambie	Field supplies	7.28
29	153	Edwin Sherman	Services, October, 1891	50.00
29	154	Charles Schwartz	......do	50.00
29	155	Louis Schwartz	......do	50.00
29	156	H. T. Davis	......do	55.00
29	157	S. S. Hooper	......do	50.00
29	158	J. M. Dikeman	......do	75.00
29	159	R. B. Marshall	......do	101.10
29	160	A. F. Dunington	......do	151.60
29	161	Pay roll	......do	370.00
29	162	......do	......do	528.14
31	163	W. T. Griswold	Subsistence	30.00
31	164	C. W. Lake	Forage	19.50
31	165	......do	......do	16.50
31	166	Jas. W. Spencer	Field expenses	39.85
		Total		18,822.36
Nov. 7	1	A. H. Thompson	Traveling expenses	236.90
18	2	Pay roll	Services, October, 1891	290.00
18	3	......do	......do	226.60
18	4	......do	......do	743.16
18	5	......do	......do	329.80
18	6	......do	......do	344.80
18	7	Willard D. Johnson	......do	168.50
18	8	H. E. Clermont Feusier	......do	101.10
18	9	Thos. F. Smith	......do	50.00
18	10	Cyrus C. Babb	......do	60.00
18	11	......do	Field expenses	133.00
18	12	......do	......do	135.50
18	13	Frank Tweedy	......do	51.95
18	14	A. P. Davis	......do	52.95
18	15	J. B. Lippincott	......do	60.09
18	16	R. H. Chapman	......do	72.90
18	17	H. E. Clermont Feusier	......do	58.05
18	18	......do	......do	10.00
18	19	......do	......do	31.85
18	20	Perry Fuller	......do	35.70
18	21	......do	......do	15.65
18	22	......do	......do	2.40
18	23	Wm. P. Trowbridge, jr	......do	86.24
18	24	......do	......do	107.55
18	25	Willard D. Johnson	......do	130.00
18	26	E. T. Perkins, jr	......do	28.85
18	27	......do	......do	103.20
18	28	W. T. Griswold	......do	71.96
18	29	......do	......do	90.96
18	30	C. H. Fitch	......do	22.63
18	31	Alex. C. Barclay	......do	92.15
18	32	E. M. Douglas	......do	44.41
18	33	......do	......do	230.15
18	34	T. E. Grafton	Traveling expenses	69.70

Abstract of disbursements made by James W. Spencer, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Nov. 18	35	W. T. Griswold	Traveling expenses	$24.25
18	36	A. H. Vail	Forage	17.54
18	37	Stevenson Brothers	Field supplies	67.32
18	38	Occidental Hotel	Subsistence	9.75
18	39	do	do	49.00
18	40	M. Schiller & Son	do	82.09
19	41	H. S. Ballou	do	60.40
19	42	J. D. Babcock & Co	do	42.00
19	43	do	do	33.00
19	44	M. Aberle	do	48.00
19	45	McKay & McLean	do	54.50
19	46	Geo. Morrison	do	6.00
19	47	do	do	103.14
19	48	do	do	69.37
19	49	J. P. Marks	Transportation	45.00
19	50	do	do	77.70
19	51	Geo. Tschirgi	Field expenses	23.00
19	52	Morton Witt	do	37.75
19	53	C. H. Sharp	do	79.76
19	54	Joseph Veltmann	Field supplies	77.80
19	55	E. Holekamp	do	171.95
19	56	Miner & Miner	do	60.40
19	57	J. House	do	30.05
19	58	E. A. Stuart	do	169.80
19	59	E. E. Burgess	do	51.63
19	60	C. E. Hutchinson	Forage	9.86
19	61	H. Lippoldt	do	26.50
19	62	J. P. Chinn	do	19.50
19	63	do	do	22.95
19	64	Coffin & Seeton	do	253.50
19	65	Denver Transit and Warehouse Co.	Storage	20.00
19	66	C. Jacobs	do	29.33
19	67	C. C. Martin	Services	29.33
19	68	Frank C. Barber	Services, October, 1891	12.00
19	69	H. T. Cummins	Services, November, 1891	27.00
19	70	S. H. Coxhead	Services, September, 1891	50.00
20	71	Pay roll	Services, October	211.10
21	72	do	Services, November	49.98
21	73	E. M. Douglas	Traveling expenses	60.00
21	74	Frank Tweedy	do	87.35
21	75	H. S. Wallace	do	29.25
21	76	R. U. Goode	do	162.30
21	77	do	Pasturage	2.75
21	78	Frank Tweedy	Field expenses	34.62
21	79	William S. Post	do	366.62
23	80	Charles F. Urquhart	do	197.30
23	81	R. O. Gorden	do	215.22
23	82	Frank Tweedy	do	63.75
23	83	E. McL. Long	do	16.60
23	84	Kilpatrick Brothers & Collin	Field supplies	11.75
23	85	Joseph Veltmann	do	53.35
23	86	Francisco Bruscher	do	12.90
23	87	S. Ecker	Subsistence	83.75
23	88	S. C. Crawshaw	do	10.00
23	89	Coffin & Secton	Forage	55.90
23	90	O. T. Triplett	do	20.90
23	91	J. H. Bush	do	12.00
24	92	E. S. Yeomans	Field supplies	218.40
24	93	R. H. Chapman	Field expenses	86.32
24	94	R. B. Marshall	do	43.85
24	95	Willard D. Johnson	do	44.00
24	96	Charles F. Urquhart	do	54.40
24	97	do	Traveling expenses	69.50
24	98	James W. Spencer	do	55.41
24	99	A. F. Dunnington	do	143.25
24	100	do	Field expenses	185.08
27	101	H. S. Wallace	do	14.45
25	102	Morris Bien	do	209.35
27	103	do	do	730.80
27	104	Robert A. Farmer	do	85.72
27	105	do	Traveling expenses	76.30
27	106	C. H. Stone	do	34.00
27	107	Chas. B. Green	do	73.25
27	108	Frank Tweedy	Forage	61.06
28	109	Wm. H. Otis	Traveling expenses	70.75
28	110	Alex. C. Barclay	do	50.25
28	111	do	Field expenses	46.58
28	112	Jeremiah Ahern	do	76.14
28	113	P. V. S. Bartlett	do	89.04

Abstract of disbursements made by James W. Spencer, etc.—Continued

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Nov. 28	114	Wm. H. Herron	Field expenses	$53.60
28	115	John H. Duling	do	53.75
28	116	E. E. Burgess	Field supplies	31.67
28	117	The International Okonite Co. (Limited).	do	8.00
28	118	Geo. O. Glavis, jr	Traveling expenses	85.25
30	119	Frank E. Gove	do	6.75
30	120	Perry Fuller	do	29.25
30	121	R. C. McKinney	do	85.50
30	122	do	Field expenses	140.50
30	123	T. M. Bannon	do	105.00
30	124	H. E. Clermont Feusier	do	51.70
30	125	The Transit and Warehouse Co.	Storage	20.00
30	126	Stephen R. Pratt	Forage	54.00
30	127	J. S. Campbell	Services, November, 1891	41.66
30	128	W. H. Crary	do	55.00
30	129	O. W. Hanson	do	20.00
30	130	E. C. Kelsey	Services, July, 1891	50.00
30	131	D. P. Amington	Services, November, 1891	40.00
30	132	Wm. H. Herron	do	114.20
30	133	R. Balfour Robertson	do	43.33
30	134	T. E. Grafton	do	60.00
30	135	T. M. Bannon	do	75.00
30	136	Sigmund Seligsburger	do	26.66
30	137	H. E. Clermont Feusier	do	97.80
30	138	P. V. S. Bartlett	do	81.60
30	139	Pay roll	do	360.00
30	140	do	do	414.60
30	141	do	do	222.80
30	142	do	do	535.00
30	143	do	do	173.40
30	144	do	do	2,427.00
30	145	Paul Holman	do	68.40
		Total		16,196.58
Dec. 2	1	A. H. Thompson	Traveling expenses	207.20
2	2	Pay roll	Services, November, 1891	203.33
4	3	Perry Fuller	Forage	4.68
5	4	Pay roll	Services, November, 1891	492.40
5	5	do	do	196.40
5	6	W. F. Coxhead	Services, October, 1891	50.00
5	7	Wesley Pratt	Services, November, 1891	13.33
7	8	R. H. Chapman	do	130.40
7	9	E. M. Douglas	Field expenses	8.15
7	10	Wm. S. Post	do	62.45
7	11	Redick H. McKee	do	66.24
7	12	J. W. Dobbins	do	13.75
8	13	C. C. Bassett	do	10.50
8	14	Morris Bien	do	20.50
8	15	do	Traveling expenses	53.25
11	16	J. B. Lippincott	Field expenses	40.25
11	17	S. P. Johnson	do	2.25
11	18	M. W. Spencer	Field supplies	2.71
11	19	John Schyler	do	1.38
11	20	S. V. R. Johnson	do	27.95
11	21	Elliott & Co	do	136.79
12	22	Paul Holman	Traveling expenses	65.40
21	23	R. O. Gordon	do	69.50
24	24	Robt. J. Breckenridge	do	84.50
24	25	H. H. Chumlea	do	89.75
24	26	Wm. H. Herron	do	84.30
24	27	W. J. Lloyd	do	66.55
24	28	C. H. Fitch	do	66.55
24	29	R. C. McKinney	Field expenses	89.94
24	30	do	do	23.15
24	31	Morris Bien	do	449.50
26	32	Cyrus C. Babb	do	145.00
26	33	do	do	20.00
26	34	do	Field supplies	10.80
26	35	G. T. Nash	do	7.00
26	36	Darling, Brown & Sharp	Instruments	81.00
26	37	John R. Brennon	Subsistence	81.50
26	38	do	do	19.50
26	39	Daniel Ferguson	Forage	22.25
26	40	A. F. Dignowitz	Pasturage	31.43
26	41	Coffin & Secton	do	28.00
26	42	Howard Worth	Transportation	16.00
26	43	E. S. Ritchie & Sons	Repairs	9.75
26	44	Joseph Jacobs	Traveling expenses	43.50

Abstract of disbursements made by James W. Spencer, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1891.				
Dec. 26	45	Pay roll	Services, November, 1891	$207.80
26	46	C. M. Gordon	do	40.00
26	47	D. H. Sager	Services, December, 1891	24.10
26	48	S. S. Mitchell	do	29.09
26	49	J. F. Mitchell	do	12.03
26	50	Chas. H. Woodbury	do	18.00
26	51	E. M. Douglas	Field expenses	14.00
29	52	H. E. Clermont Feusier	do	4.00
29	53	do	do	1.70
29	54	William S. Post	do	201.42
29	55	Redick H. McKee	do	20.00
29	57	A. P. Davis	do	120.48
29	58	R. H. Chapman	do	32.70
29	59	Willard D. Johnson	do	53.05
29	59	do	do	32.95
29	60	do	do	50.70
29	61	do	Traveling expenses	25.12
29	62	W. P. Powell	do	16.25
29	63	H. E. Clermont Feusier	do	93.80
29	64	P. V. S. Bartlett	do	76.65
29	65	J. A. Sturgis	Field supplies	52.44
29	66	James B. Lambie	do	7.85
31	67	Amos Baggott	Pasturage	84.00
31	68	T. J. Weldon	Storage	15.00
31	69	A. P. Davis	Field expenses	27.91
31	70	Pay roll	Services, December, 1891	454.30
31	71	do	do	1,114.50
31	72	Pay roll	Services, December, 1891	547.50
16	73	Robert J. Breckenridge	Services, September, 1891	50.00
28	74	do	Services, October, 1891	17.71
31	75	Pay roll	Services, December, 1891	3,155.60
31	76	Joseph Jacobs	do	60.00
31	77	Frank Frates	Pasturage	40.60
31	78	Stephen R. Pratt	do	54.00
31	79	A. F. Dignowitz	do	33.00
31	80	P. Fee	do	142.00
31	81	Thomas Davis	Forage	44.51
31	82	Wheeler & Dennison	do	30.00
31	83	Frank Fuqua	do	36.00
31	84	Robert Florman	do	19.00
31	85	Willard D. Johnson	Field expenses	30.75
		Total		10,339.29
1892				
Jan. 1	1	The Denver Transit and Warehouse Co.	Storage	20.00
7	2	Frank E. Gove	Services, December, 1891	40.76
8	3	Pay roll	do	175.80
11	4	T. M. Bannon	Field expenses	165.41
11	5	do	Traveling expenses	84.35
12	6	Henry W. Taylor	Field supplies	29.58
12	7	Maud Crawshaw	Subsistence	24.05
12	8	Pay roll	Services, November, 1891	21.33
12	9	J. B. Aleshire	Forage	20.88
12	10	A. G. Ericsonn	Pasturage	34.70
12	11	Coffin & Secton	do	20.78
13	12	James Crockett	do	99.70
14	13	E. McL. Long	Field expenses	22.20
14	14	Ralph Wonnelle	Traveling expenses	13.00
15	15	Stuart P. Johnson	do	16.50
15	16	Jeremiah Ahern	do	4.40
15	17	W. T. Griswold	Field expenses	8.15
16	18	Frank Tweedy	do	11.89
18	19	Amos Scott	Services, December, 1891	60.00
23	20	Jackson & Co	Forage	4.38
23	21	Sparks Bros	do	25.00
25	22	Paul Holman	Field expenses	25.20
26	23	W. T. Griswold	do	8.15
28	24	Cyrus C. Babb	do	130.50
28	25	Wm. S. Post	do	175.27
28	26	do	Traveling expenses	67.55
28	27	H. J. Veltmann	Field supplies	101.09
28	28	do	do	112.92
30	29	E. S. Yeomans	do	23.15
30	30	J. M. Witmer	Storage	15.00
30	31	The Denver Transit and Warehouse Co.	do	20.00
30	32	Pay roll	Services, January, 1892	3,135.00
30	33	do	do	408.70

Abstract of disbursements made by James W. Spencer, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
Jan. 30	34	Pay roll	Services, January, 1892	$1,097.70
30	35	do	do	551.80
30	36	do	do	176.60
30	37	Robert J. Breckinridge	do	25.80
30	38	Joseph Jacobs	do	60.00
		Total		7,037.29
Feb. 8	39	Stephen R. Pratt	Pasturage	54.00
4	40	Coffin & Secton	do	28.00
5	41	A. F. Dignowitz	do	33.00
5	42	Joseph Jacobs	Field expenses	10.10
5	43	William S. Post	do	4.00
5	44	D. H. Sager	Traveling expenses	19.50
6	45	S. S. Mitchell	do	24.45
6	46	A. P. Davis	Field expenses	55.61
8	47	Thos. F. Smith	Services, January, 1892	11.61
8	48	M. P. Henderson & Son	Storage	24.00
9	49	R. B. Marshall	Field expenses	42.50
9	50	W. T. Griswold	do	76.90
10	51	E. McL. Long	do	19.90
10	52	Stewart & Trowbridge	Field supplies	86.25
10	53	Henry W. Taylor	do	5.71
10	54	A. J. Lyons	Pasturage	85.75
10	55	M. P. Henderson & Son	Storage	12.00
10	56	Geo. R. Arlin	Services, January, 1892	9.67
10	57	Amos Scott	Services, November, 1892	60.00
11	58	A. C. Sherman	Services, January, 1892	16.75
12	59	James Crockett	Forage	69.00
16	60	A. G. Ericsson	Pasturage	16.20
19	61	Cyrus C. Babb	Field expenses	105.50
20	62	Ed. Naegelin	Field supplies	165.10
20	63	Samuel McDowell	Pasturage	59.35
27	64	J. W. Dobbins	Traveling expenses	31.77
27	65	Joseph Jacobs	Services, February, 1892	8.75
27	66	Austin Bros	Field supplies	3.96
27	67	Southworth & Grattan	do	2.50
27	68	Hale & Co	do	11.20
29	69	S. R. Pratt	Forage	54.00
29	70	James Crockett	do	66.00
29	71	A. F. Dignowitz	Pasturage	83.00
29	72	Coffin & Secton	do	28.00
29	73	Irwin & Co	Storage	40.00
29	74	J. M. Witmer	do	15.00
29	75	The Denver Transit & Warehouse Co.	do	20.00
29	76	Joseph Jacobs	Services, February, 1892	60.00
29	77	Amos Scott	Services, January and February, 1892.	120.00
29	78	Pay roll	Services, February, 1892	526.40
29	79	do	do	171.50
29	80	do	do	382.60
29	81	do	do	1,044.60
29	82	do	do	2,999.00
		Total		6,713.42
Mar. 5	83	Paul Holman	Field expenses	6.00
9	84	Frank Tweedy	do	70.37
10	85	G. Rollin Durand	Services, February, 1892	5.00
10	86	M. P. Henderson & Son	Storage	12.00
10	87	do	Field supplies	29.80
10	88	H. W. Taylor	do	5.18
10	89	V. R. Sherman	Field expenses	19.00
10	90	E. McL. Long	do	14.75
10	91	Stewart & Trowbridge	Forage	10.50
11	92	Willard D. Johnson	Field expenses	48.60
15	93	H. E. Clermont Feusier	do	10.55
15	94	Lawson & Catts	Material for maps	42.30
15	95	Hale & Co	do	14.66
15	96	Austin Brothers	Field supplies	3.65
22	97	A. J. Lyons	Pasturage	89.25
28	98	Cyrus C. Babb	Field expenses	107.50
31	99	W. T. Griswold	do	51.10
31	100	The Denver Transit and Warehouse Co.	Storage	20.00
31	101	Jas. J. Hopkins	Pasturage	102.00
31	102	Coffin & Secton	do	28.00
31	103	A. F. Dignowitz	do	33.00

Abstract of disbursements made by James W. Spencer, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
Mar. 31	104	Eva Shuster	Services, March, 1892	$54.00
31	105	Amos Scott	do	60.00
31	106	Pay roll	do	1,097.70
31	107	do	do	408.70
31	108	do	do	551.80
31	109	do	do	176.60
31	110	do	do	3,108.80
		Total		6,180.81
Apr. 1	1	Stephen R. Pratt	Pasturage	54.00
1	2	W. G. Van Sandt	Field expenses	23.00
8	3	R. H. Chapman	do	6.00
8	4	T. R. Sherman	Forage	78.00
8	5	J. M. Witmer	Storage	15.00
8	6	W. McIntosh	Repairs	33.50
11	7	E. McL. Long	Field expenses	81.20
11	8	Robt. Flosmann	Storage	24.00
13	9	M. G. Henderson & Son	do	12.00
13	10	A. J. Lyons	Forage	114.75
13	1	Hale & Co	Material for maps	14.20
13	2	Henry Wiedersheim	Maps	14.50
28	3	Lanxon & Catts	Field supplies	7.80
28	4	A. P. Davis	Field expenses	15.45
28	5	J. W. Dobbins	do	10.00
28	6	W. T. Griswold	do	33.40
28	7	Cyrus C. Babb	do	122.50
28	8	Jos. McClain	Field supplies	11.45
30	9	A. G. Ericsson	Pasturage	54.00
30	20	James Crockett	do	66.00
30	1	do	do	66.00
30	2	Denver Transit and Warehouse Co.	Storage	20.00
30	3	J. M. Witmer	do	15.00
30	4	Frank Fuqua	do	40.00
30	5	Eva Shuster	Services, April, 1892	50.00
30	6	Amos Scott	do	60.00
30	7	Pay roll	do	174.20
30	8	do	do	539.10
30	9	do	do	724.90
30	30	do	do	395.60
30	31	do	do	2,493.50
		Total		5,369.05
May 3	32	C. Kuhnol	Map sheets	24.84
6	33	Hale & Co	Material for maps	11.70
14	34	V. R. Shannan	Forage	106.80
14	35	M. P. Henderson & Son	Storage, April, 1892	12.00
14	36	do	Pasturage	108.00
14	37	Stuart P. Johnson	Services, May, 1892	41.21
16	38	W. J. Lloyd	do	29.03
16	39	W. T. Griswold	Field expenses	27.55
19	40	Frank Tweedy	do	38.65
19	41	A. T. Dignowitz	Pasturage, April, 1892	33.00
19	42	Coffin & Secton	do	28.00
19	43	Stephen R. Pratt	Forage	54.00
19	44	Cyrus C. Babb	Field expenses	121.45
24	45	E. McL. Long	do	20.20
24	46	Ed. Naegelin	Field supplies	81.08
24	47	E. S. Ritchie & Sons	do	7.50
24	48	James B. Lambie	do	35.47
24	49	Jeff. D. Reagan	Services, May	29.03
31	50	R. B. Marshall	Field expenses	78.51
31	51	Willard D. Johnson	do	29.10
31	52	W. McIntosh	do	10.50
31	53	Jeff. D. Reagan	Traveling expenses	18.65
31	54	The Denver Transit and Warehouse Company.	Storage, May, 1892	20.00
31	55	Adolph Listz	Repairs	7.25
31	56	Eva Shuster	Services, May, 1892	50.00
31	57	C. H. Stone	do	85.20
31	58	Pay roll	do	116.60
31	59	do	do	230.40
31	60	do	do	152.20
31	61	do	do	606.76
31	62	do	do	2,001.79
		Total		4,216.47

Abstract of disbursements made by James W. Spencer, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
June 9	63	A. H. Thompson	Traveling expenses	$113.25
15	64	E. McL. Long	Field expenses	34.00
15	65	......do	......do	19.75
15	66	P. A. Buell & Co	Field supplies	13.08
15	67	Ed. Naegelin	......do	31.00
15	68	Hale & Co	Material for maps	13.05
15	69	Stephen R. Pratt	Forage	48.00
15	70	A. F. Dignowitz	Pasturage	33.00
15	71	Coffin & Secton	......do	28.00
15	72	Amos Scott	Services, May, 1892	60.00
15	73	Arthur P. Davis	......do	170.40
15	74	J. B. Lippincott	......do	119.20
16	75	M. P. Henderson & Son	Storage	12.00
16	76	......do	Pasturage	105.75
16	77	Cyrus C. Babb	Field expenses	31.00
20	78	......do	......do	142.00
22	79	Chas. F. Urquhart.	Traveling expenses	25.25
23	80	E. McL. Long	Field expenses	5.60
24	81	Easton & Rupp	Supplies	.80
24	82	Eva Shuster	Services, June, 1892	15.00
30	83	Pay roll, Johnson	......do	296.70
30	84	Pay roll, Thompson	......do	1,772.55
30	85	Pay roll, Griswold	......do	224.80
30	86	A. P. Davis	......do	164.80
30	87	E. McL. Long	......do	74.20
30	88	Pay roll, McKee	......do	175.23
30	89	Pay roll, Marshall	......do	148.90
30	90	A. H. Thompson	Traveling expenses	166.50
30	91	R. H. Chapman	Field expenses	35.70
30	92	Redick H. McKee	......do	23.95
30	93	W. T. Griswold	......do	54.47
30	04	A. P. Davis	......do	2.45
30	05	Cyrus C. Babb	......do	9.80
30	06	Robt. Flormann	Storage, April, May, and June, 1892.	24.00
30	97	The Denver Transit and Warehouse Company.	Storage, June, 1892	20.00
30	98	R. T. Brown	Services, June, 1892	25.00
30	99	Amos Scott	......do	60.00
		Total		4,299.18

Abstract of disbursements made by Arnold Hague special disbursing agent, U. S. Geological Survey, during the fiscal year 1891–1892.

1891.				
July 31	1	Pay roll of employés	Services, July, 1891	$758.20
31	2	......do	......do	185.00
Aug. 31	3	......do	Services, August, 1891	758.20
31	4	......do	......do	185.00
Sept. 30	1	......do	Services, September, 1891	635.80
30	2	J. C. McCartney	Field expenses	15.75
30	3	Pay roll of employés	Services, September, 1891	185.00
Oct. 31	1	Elwood Hofer	Services	50.00
31	2	Pay roll of employés	Services, September, 1891	157.00
31	3	......do	Services, October, 1891	185.00
31	4	......do	......do	185.00
Nov. 3	1	Arnold Hague	Traveling expenses	97.15
10	2	Peter Koch	Field expenses	16.00
12	3	Jos. P. Iddings	Traveling expenses	91.30
12	4	Pay roll of employés	Services, October, 1891	657.10
20	5	Arnold Hague	Field expenses	107.67
21	6	Jos. P. Iddings	......do	19.09
30	7	Pay roll of employés	Services, November, 1891	407.60
30	8	Walter H. Weed	Field expenses	33.40
30	9	......do	Traveling expenses	33.00
30	10	......do	......do	27.70
Dec. 12	1	Yellowstone Park Association	Field supplies	44.03
21	2	Jos. P. Iddings	Traveling expenses	34.28
30	3	Arnold Hague	Services, November, 1891	326.00
30	4	Pay roll of employés	Services, December, 1891	758.20
1892.				
Jan. 6	1	Frederick Koch	Field expenses	8.05
6	2	......do	Services, November and December, 1891.	90.00
27	3	John S. Mendenhall	Field supplies	138.49
27	4	Highsmith & Winter	Field expenses	38.50
27	5	The Eastman Company	Photographic supplies	31.80

Abstract of disbursements made by Arnold Hague, etc.—Continued.

APPROPRIATION FOR U. S. GEOLOGICAL SURVEY—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
Jan. 31	6	Pay roll of employés	Services, January, 1892	$766.50
Feb. 24	1	E. J. Owenhause	Storage	30.00
29	2	Pay roll of employés	Services, February, 1892	717.00
Mar. 23	1	Frederich Koch	......do	90.00
31	2	Pay roll of employés	Services, March, 1892	766.50
Apr. 30	1	......do	Services, April, 1892	741.70
May 20	1	Frederick Koch	Services	90.00
31	2	Pay roll of employés	Services, May, 1892	766.60
31	3	Geo. E. Luther	......do	102.20
June 15	1	John F. Yancey	Field expenses	9.00
23	2	Highsmith & Winter	......do	41.85
29	3	Minor Berry	Field material	80.00
29	4	Robert F. King	......do	65.00
30	5	Pay roll of employés	Services, June, 1892	741.70
30	6	E. J. Owenhuose	Storage	30.00
30	7	Geo. E. Luther	Services, June, 1892	98.90
30	8	J. R. Biering	Pasturage	8.80
30	9	Bozeman Implement, Carriage, and Harness Co.	Field supplies	112.60
30	10	John S. Mendenhall	......do	125.33
30	11	Walter H. Weed	Traveling expenses	43.75
30	12	Frederick Koch	Field expenses	14.25
30	13	......do	Services, May, 1892	36.27
30	14	......do	......do	13.55
30	15	J. B. Koch	......do	19.51
30	16	Pay roll of employés	Services, June, 1892	185.00
30	17	John Gallagher	Field material	19.00
30	18	Wm. J. Park & Sons	Stationery and photographic supplies.	27.50
30	19	C. R. Van Hise	Traveling expenses	244.85
30	20	Walter H. Weed	Field expenses	13.91
30	21	R. S. Tarr	Expressage, etc	9.30
30	22	F. Woody	Services, May and June, 1892	29.83
		Total		12,299.71

Abstract of disbursements made by J. S. Diller, special disbursing agent, U. S. Geological Survey, during April, May, and June, 1892.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1892.				
Apr. 11	1	I. C. Russell	Traveling expenses	$38.90
12	2	J. S. Diller	......do	33.55
14	3	Al. Curran	1 horse	75.00
14	4	......do	......do	60.00
14	5	Alex. R. Sinclair	Transportation and field material	389.50
14	6	Felitz Brothers	Field material	36.10
15	7	Theo. Steiner	Subsistence	10.00
23	8	J. S. Diller	Services, April 1 to 20, 1892	131.87
25	9	Palmer & Hart	Forage	10.20
May 2	10	I. C. Russell	Field expenses	222.13
2	11	......do	......do	56.98
3	12	Felitz Brothers	Field material	14.75
3	13	F. R. Reed	......do	100.00
3	14	John W. Golden	Services, April 1 to 30, 1892	40.00
3	15	J. E. Buchtel	Services, April 23 to 30, 1892	10.64
4	16	Theo. Steiner	Subsistence	10.00
9	17	J. S. Diller	Services, April 21 to 30, 1892	65.93
19	18	......do	Field expenses	67.80
21	19	Samuel Storrow	Services, April 12 to 30, 1892	38.00
21	20	L. A. Berteling	Instruments	10.00
21	21	Woodward, Clarke & Co.	Supplies	7.25
31	22	Pay roll of employés	Services, May, 1892	140.00
June 4	23	Chas. Lonch	Subsistence	12.65
11	24	J. S. Diller	Field expenses	48.30
13	25	J. B. Riddle	Subsistence	10.50
21	26	Jonas Halcomb	Field expenses	18.00
30	27	Pay roll of employés	Services, June, 1892	100.00
30	28	James Storrs	Services, May 9 to 31, 1892	44.51
		Total		1,802.56
		Total amount expended		587,611.14

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